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Water mites from stagnant waters of Paraguay*

by

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Abstract

Near to the Paraguayan town Concepción water mites were sampled in one shallow lake and four ponds, so-called Tajamares. These waters are characterized briefly in their abiotic aspects.

The six net catches had as a result 29 species out of 13 genera and 5 families. Six species are new to science. Just a single species is found in 7 out of 13 genera. The genus *Koenikea* is the one with the largest species number, namely 7. Only a few species show greater abundances. Many species have markedly inferior abundances: of 10 species only a single individual could be caught. Not a single species occurred in all five waters.

Keywords: **Water mites, Hydrachnidia, stagnant waters, Paraguay.**

Resumo

Ácaros aquáticos foram coletados em um lago razo e em quatro pequenos brejos, chamados 'Tajamares', perto da cidade de Concepción, no Paraguay. Estes corpos d'água são brevemente caracterizados em seus aspectos abióticos. Nas 6 coletas com rede foram encontradas 29 espécies de 13 géneros e 5 famílias diferentes. Seis das espécies são novas para a ciência. Em 7 dos 13 géneros foram encontrados apenas uma espécie. O género *Koenikea* tem o maior número de espécies, ou seja 7. Somente algumas poucas espécies demonstram uma abundância maior. Muitas espécies têm uma abundância bem menor: em 10 espécies apenas um único indivíduo foi coletado. Nehuma espécie ocorreu em todos os cinco corpos d'água.

*In memoriam Dr. Dr. h.c. Kurt O. Viets, 26386 Wilhelmshaven, Germany.

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Introduction

During his first collecting trip to Paraguay the coauthor sampled altogether 31 species of Hydrachnidia, out of 11 families and 16 genera (VIETS & BÖTTGER 1986). From the middle of September to the end of October 1985 the coauthor took a second trip to Paraguay. This time water mites were exclusively sampled in a well-restricted area near to Concepción. The five waters chosen are one shallow lake and four ponds, so-called 'Tajamares'.

The results of samples simultaneously taken on Rotifera (KOSTE 1986) and fishes (BRINKMANN & BÖTTGER 1990) are published already. Observations concerning the vegetation, made by fellow-travellers of Böttger in the area of Concepción at the same time, are published as well (WOLF 1990). The present publication represents a further contribution to the still very incomplete knowledge of the Paraguayan limnofauna.

Area examined and methods

Concepción (latitude 23°25'south, longitude 57°25'west) lies about 200 km north of the Paraguayan capital Asunción, directly on the left side of the Rio Paraguay. Refering to temperature and precipitation conditions the climate is specified as subtropic. During the time of sampling in September/October 1985 the daily amplitude of air temperature exceeded 20 °C (night-time cooling down to 13 °C, day-time heating up to 40 °C). The annual precipitation amount is 1500-2000 mm, whereas the distribution over single months is very unbalanced (Table 1 and WOLF 1990); the largest precipitation amounts are usually found from March-May, the smallest from August-October.

Tab. 1: Precipitation in the years 1982-1985 in the examined area near to Concepción (Paraguay). Measurements at the Estancia Ybú.

	J	F	M	A	M	J	J	A	S	O	N	D	S
1982	68	197	265	35	45	67	16	61	169	198	281	218	1620 mm
1983	165	93	294	418	483	84	111	1	97	68	136	123	2073 mm
1984	172	30	209	188	26	44	30	77	32	84	328	340	1560 mm
1985	43	119	228	160	87	73	135	13	36	39	50	129	1112 mm

At Concepción the Rio Ypané, coming from the east, flows into the Rio Paraguay (sketch map, see KOSTE 1986 and WOLF 1990). The waters examined are located on both sides of the Rio Ypané, north in the area of the 'Estancia Ybú' (= syn. 'Estancia Los Manantiales') and south in the area of the 'Estancia Santa Maria'. The collection localities 'Hy 1' and 'Hy 2' (Hy for Hydrachnidia) represent the littoral zones of just the same lake. The collection sites 'Hy 3'-'Hy 6' lie at four different ponds: These

ponds, so-called 'Tajamares' , are of natural kind, but were deepened by man in order to serve the cattle of the surrounding pastureland with water even in times of drought. According to residents these our ponds belonging to the 'Estancia Ybú' have not drained for 10 years. Especially the aquatic macrophytes and an abundant ichthyofauna indicate a permanent water yield (BRINKMANN & BÖTTGER 1990).

Hydrachnidia were caught by means of sweeping nets (mesh size 250 µm) and picked alive. As usual they were preserved in a solution of glycerol, acetic acid and water (10:3:6).

Data about the collection localities

The collection localities of the water mite samples 'Hy 1'-'Hy 6' have already been characterized in KOSTE (1986) and BRINKMANN & BÖTTGER (1990). Moreover, the locality of 'Hy 6' is the same as 'Fundort 4' described by VIETS & BÖTTGER (1986). Therefore just some very significant data will be given here:

Collection locality of 'Hy 1' and 'Hy 2'

(Identical to 'Probestelle 2' in KOSTE 1986 and 'Untersuchungsgewässer FS' in BRINKMANN & BÖTTGER 1990). Shallow lake south of the Rio Ypané and 1 km east of the Estancia Santa Maria. Lake surface about 500 x 1000 m. Without outflow, thus its depth is subjected to strong fluctuations in the course of the year. Minimum depth during the examined time interval at the end of the drought period up to 1.5 m. On the water surface extensive 'floating meadows'. Water acidic (pH-value 5.8-6.6) and of small lime content. Conductivity up to 80 μS_{20}/cm; alkalinity to 0.7. Water temperatures (20.5-34.0 °C) and oxygen concentrations (saturation index 22-129 %) reveal big daily fluctuations. Sample 'Hy 1' was taken at the northeastern lake shore on 27.09.1985, namely from the 30 cm thick water layer between communities of floating plants and the ground. Additionally several bunches of *Salvinia auriculata* were rinsed. The sampling of 'Hy 2' was performed at the southeastern lake shore, in the transition zone from floating vegetation to a free water-surface. Water depth 0.6 m.

Collection locality of 'Hy 3'

(Identical to 'Probestelle 3' in KOSTE 1986 and 'Kleingewässer K 1' in BRINKMANN & BÖTTGER 1990). Pond 400 m southwest of the Estancia Ybú. Surface extent of 15 x 15 m. Water depth up to 1 m. Aquatic macrophytes (mainly *Nymphoides indica* with communities of 4 m in width and *Eleocharis* sp.) form a belt along the shore. In between the macrophytes single aggregations of algae. Compared to the three other Tajamares relatively strong impact by cattle (squashing; conductivity 95 μS_{20}/cm); pH-value 7.9. Sample 'Hy 3' was taken on 01.10.1985.

Collection locality of 'Hy 4'

(Identical to 'Probestelle 4' in KOSTE 1986 and 'Kleingewässer K2' in BRINKMANN & BÖTTGER 1990). Tajamar 800 m northeast of the Estancia Ybú. Surface extent 50 x 60 m. Water depth up to 3 m. The water is walled in with earth. Apart from precipitation, water from neighbouring springs feeds the pond. Impact by cattle (squashing, eutrophication) is averted by a fence. Conductivity up to 38 μS_{20}/cm; pH-value

6.3. High densities of macrophytes (mainly *Eichhornia azurea*) especially at the north and southwest shore. Here are found particularly strong daily fluctuations of the water temperature. For example, in the morning (8.00am) of 1.10.1985 there were measured 20.8 °C and in the afternoon (4.00pm) 33.6 °C.

For sample 'Hy 4' *Eichhornia*-communities as well as the neighbouring free water were examined on 01.10.1985.

Collection locality of 'Hy 5'

(Identical to 'Probestelle 5' in KOSTE 1986 and 'Kleingewässer K 3' in BRINKMANN & BÖTTGER 1990). Tajamar 1000 m north of the Estancia Ybú. Surface extent 50 x 70 m. Water depth in excess of 2 m. This water is also fed by springs. The impact by cattle is small (conductivity in 2 runs 37-56 μS_{20}/cm); pH-value 6.9-8.0. Only weak development of macrophytes (*Nymphoides indica* in small numbers; sporadically Cyperaceae-communities) at the steep shores. On 12.10.1985 sampling in free water as well as in communities of *Nymphoides indica*.

Collection locality of 'Hy 6'

(Identical to 'Probestelle 6' in KOSTE 1986, 'Fundort 4' in VIETS & BÖTTGER 1986 and 'Kleingewässer K 4' in BRINKMANN & BÖTTGER 1990). Tajamar 300 m south of the Estancia Ybú. Surface extent 20 x 20 m. Water depth up to 0.8 m. Again the pond is fed by spring water and therefore perennial despite of its small size. The water surface is covered nearly completely by plants with floating leaves (see Fig. 3 in VIETS & BÖTTGER 1986). The impact by cattle is small. Conductivity in 2 runs 30-52 μS_{20}/cm; pH-value 5.8-6.2. Sample 'Hy 6' was taken on 13.10.1985.

Taxonomy

All the specimens studied are temporarily deposited in the Zoological Museum of 'Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de Córdoba, Argentina'. Measurements of all the specimens are given in micrometer (µm); those of the holotype and allotype are given first; if there are other specimens, their measurements will be in parenthesis.

Family Eylaidae LEACH

Genus *Eylais* LATREILLE

Three species of the genus *Eylais* are known from Paraguay (VIETS & BÖTTGER 1986; VIETS 1987).

Eylais protendens (BERLESE 1888)

Eylais extendens protendens BERLESE 1888. Bull. Soc. Entom. ital. **20**: 49;

Eylais protendens RIBAGA 1903. Ann. Scuola super Agricol. **5**: 9; VIETS & BÖTTGER 1986. Stud. Neotrop. Fauna Environ. **21**: 109.

Only a part of a specimen was found; the ocular plate 160 in length, 230 in width; ocular bridge short and wide; anterior coxal group 553 in widest measurement; dorsal lengths of the palpal segments: P-I: 79; P-II: 134; P-III: 141; P-IV: 259; P-V: broken;

dorsal lengths of the distal segments of the first leg: I-leg-4: 310; I-leg-5: 370; I-leg-6: 340; with swimming hairs.

Material examined: 1 specimen from 'Hy 3'.

Discussion: BERLESE (1888) described this species and RIBAGA (1903) redescribed and illustrated *Eylais protendens*, though, without defining some morphological aspects. But the ocular plate and the palp of the present specimen agree well with those illustrated by RIBAGA.

Family Hydrodromidae VIETS

Genus *Hydrodroma* KOCH

Altogether two species and one subspecies are known from Paraguay (VIETS 1987) and the following species is one of them.

***Hydrodroma peregrina peregrina* (KOENIKE 1905)**

See VIETS (1987) for the synonymy of this species.

This species has been reported from Paraguay, Brazil, Argentina and Mexico, and it is very variable (COOK 1980).

Material examined: 1 female from 'Hy 1'; 16 females and 1 male from 'Hy 3'; 3 females from 'Hy 4'; 2 females from 'Hy 5'.

Family Anisitsiellidae VIETS

***Mamersellides ventriperforatus* LUNDBLAD 1937**

See VIETS (1987) for the synonymy of this widely distributed neotropical species.

Material examined: 8 females and 1 male from 'Hy 1'.

Family Limnesiidae THOR

Genus *Limnesia* KOCH

16 species of this genus are known from Paraguay (VIETS & BÖTTGER 1986; VIETS 1987).

***Limnesia (Limnesia) laeta* STOLL 1887**

Limnesia laeta STOLL 1887. In: Godman & Salvin, Biologia Centrali-Americana, Zoologia **59**: 14; *Limnesia inaequipalpis* LUNDBLAD 1930. Zool. Bidr. **13**: 24; *Limnesia laeta* VIETS 1954a. Arch. Hydrobiol. **49**: 49; *Limnesia (Limnesia) laeta* COOK 1980. Mem. Amer. Ent. Inst. **31**: 83.

Male: Length of body 580; length between anterior end of the first coxae and posterior end of the fourth coxae 325; width between lateral margins of fourth coxae 460; first pair of coxae fused medially; genital field 132 in length, 185 in width; three pairs of acetabula with the same space between them (Fig. 1); gonopore not small; a pair of small and irregulate platelets posterior to genital field (Fig. 1); dorsal lengths of the palpal segments: P-I: 21; P-II: 107; P-III: 56; P-IV: 117; P-V: 41; chelicera: 234;

with small spiniform seta at distal end of P-IV and a bulge in the middle of ventral side in this segment; P-II with a ventral tubercle bearing a peg-like seta and the dorsal side several pilose setae of different size; Fig. 2 illustrates the palpal morphology; dorsal lengths of the distal segments of the first leg: I-leg-4: 95; I-leg-5: 107; I-leg-6: 111; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 140; IV-leg-5: 160; IV-leg-6: 152; seta at tip of IV-leg-6: 115; IV-leg-5 with five swimming hairs.

Material examined: 1 male from 'Hy 1'.

Discussion: The only specimen found in Paraguay agrees well with the descriptions by LUNDBLAD (= *L. inaequipalpis* LUNDBLAD 1930), VIETS (1954a) and COOK (1980) and shows the same difference in the genital field compared with the northern populations noted by the latter author. This species has been reported from the North of Argentina (LUNDBLAD 1930), Amazonas (Brazil, VIETS 1954a), Guatemala (STOLL 1887) and Mexico (COOK 1930).

***Limnesia (Limnesia) latigenitalis* LUNDBLAD 1937**

Limnesia (Limnesia) latigenitalis LUNDBLAD 1937. Zool. Anz. **118**(1-2): 250; LUNDBLAD 1941. Svensk. Vetenskapsakad. Handling **19**(7): 131; LUNDBLAD 1953. Ark. Zool. **5**(8): 489. This species has been described and redescribed by LUNDBLAD; it was known from the South of Brazil and Paraguay.

Material examined: 1 female from 'Hy 3'.

***Limnesia (Limnesiella) duricoria* (LUNDBLAD 1937)**

Limnesia (Neolimnesia) duricoria LUNDBLAD 1937. Zool. Anz. **120**(11-12): 283; *L. (Limnesiella) duricoria* LUNDBLAD 1941. Svensk. Vetenskapsakad. Handling **19**(7): 142; LUNDBLAD 1953. Ark. Zool. **5**(8): 489.

Male: Length of body 351; dorsal shield 300 in length, 222 in width; containing five pairs of glandularia; length between anterior end of first coxae and posterior end of fourth coxae 218; width between lateral margins of fourth coxae 275; first coxae fused medially; Glandula Limnesiae located medially in a bifurcation between third and fourth coxae; genital field 109 in length, 87 in width; genital acetabula in three groups on each side: anterior group with two acetabula, middle group with two and posterior group with five or six acetabula (Fig. 4); gonopore 57 in length; P-II with a bulky, peg-like seta on ventral side and five short and pilose setae on dorsal side; (Fig. 3 shows the chaetotaxy); dorsal lengths of the palpal segments: P-I: 12; P-II: 72; P-III: 37; P-IV: 60; P-V: 25; chelicera 138; dorsal lengths of the distal segments of the first leg: I-leg-4: 62; I-leg-5: 71; I-leg-6: 82; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 78; IV-leg-5: 87; IV-leg-6: 101; subterminal seta of IV-leg-6: 91; IV-leg-4 with two swimming hairs, IV-leg-5 with one swimming hair.

Material examined: 1 male from 'Hy 4'.

Discussion: The Paraguay specimen agrees well with *L. duricoria* from the South of Brazil. However, the palp of the specimen from Paraguay reveals that the pilose setae and the 'peg-like' seta are bigger. The genital field contains, concerning the posterior group of acetabula, 11 or 12 acetabula and a smaller gonopore, referring to LUNDBLAD's drawing. This is a new finding for Paraguay's fauna.

***Limnesia (Allolimnesia) polypora* VIETS 1936**

Limnesia (Allolimnesia) polypora VIETS 1936. Zool. Anz. **113**(9-10): 210; LUNDBLAD 1941. Svensk. Vetenskapsakad. Handling **19**(7); LUNDBLAD 1953. Ark. Zool. **5**(8): 490; VIETS 1954a. Arch. Hydrobiol. **49**(1-2): 61.

Male: Length of body 677-719, width 575-632; dorsum with a posterior pair of platelets of irregular shape; length between anterior end of first coxae and posterior end of fourth coxae 415-436; width between lateral margins of fourth coxae 500-533; first coxae fused medially and posterior apodemes of anterior coxal group short; Glandula Limnesiae located on the third coxae (Fig. 6); medial seta of the third coxae located between the glandula and the medial margin; genital field 231-256 in length, 237-266 in width; genital acetabula of different size, one pair in the anterior group (but some specimens with two acetabula on only one side) bigger than the others; posterior group of acetabula vary in number and size; the number of acetabula on each side are: 6-6; 7-7; 5-7; 8-8; 7-6; 6-5; 8-6; 5-6; sometimes two acetabula are fused; Figs. 6 and 9 illustrate these variations; dorsal lengths of the palpal segments: P-I: 25-28; P-II: 155-163; P-III: 130-136; P-IV: 214-227; P-V: 56-62; ventral side of P-II with a long tubercle and a peg-like seta and the dorsal side with nine or ten short pilose setae (Fig. 5); chelicera 320-361 in length; dorsal lengths of the distal segments of the first leg: I-leg-4: 145-169; I-leg-5: 166-189; I-leg-6: 127-136; dorsal lengths of the segments of the fourth leg: IV-leg-3: 119-136; IV-leg-3: 138-160; IV-leg-4: 201-222; IV-leg-5: 226-251; IV-leg-6: 203-251; subterminal seta at tip of IV-leg-6: 224-273; IV-leg-4 with two to four swimming hairs; IV-leg-5 with five to seven swimming hairs; IV-leg-6 with three to five short pilose setae on ventral side (Fig. 7).

Female: Length of body 810-887, width 920-953; length between anterior end of the first coxae and posterior end of fourth coxae 458-582; width between lateral margins of fourth coxae 644-779; fourth coxae separated medially; posterior apodemes of anterior coxal group short; Glandula Limnesiae as described for the male; genital flaps 231-264 in length; 153-198 in width; genital acetabula of different size and four to six pairs in the posterior group (the variations were: 4-4; 4-5; 5-4; 5-5; 5-6; 6-5) (Fig. 8); most of these females were ovigerous; dorsal lengths of the palpal segments; P-I: 29-33; P-II: 206-218; P-III: 144-151; P-IV: 325-354; P-V: 72-82; chaetotaxy as for the male; chelicera 363-380 in length; dorsal lengths of the distal segments of the first leg: I-leg-4: 156-185; I-leg-5: 177-197; I-leg-6: 164-185; dorsal lengths of the segments of the fourth leg: IV-leg-2: 144-148; IV-leg-3: 160-69; IV-leg-4: 234-243; IV-leg-5: 271-288; IV-leg-6: 243-264; IV-leg-6 with subterminal seta: 325-370; IV-leg-4 with two to four swimming hairs; IV-leg-5 with six to seven swimming hairs; IV-leg-6 ventral side with three to five short, pilose setae.

Material examined: 1 female from 'Hy 2'; 24 males and 111 females from 'Hy 3'; 3 females from 'Hy 4'.

Discussion: The present specimens agree fairly well with the description and redescription by VIETS (1936, 1954a), although there are some differences in the genital field of both; VIETS' specimens have more numerous and smaller acetabula than the Paraguayan specimens but this population is variable (see the measurements and figures). On the other hand, the Paraguayan population of *L. polypora* agrees well with *Limnesia (Allolimnesia) angustipalpis* LUNDBLAD 1938 (from Southern Brazil and Paraguay) with some exceptions: a long tubercle on ventral side of P-II and its number of setae. VIETS (1954a) made a table of differences between both *L. polypora* VIETS

and *L. angustipalpis* LUNDBLAD, but some of this aspects considered are untenable. The Paraguayan specimens of this study are somewhat intermediate between the characters given for both species.

Genus *Centrolimnesia* LUNDBLAD

This neotropical genus contains eight species, of which four are found in Paraguay. In this study two species of *Centrolimnesia* are mentioned.

***Centrolimnesia schadei* LUNDBLAD 1938**

Centrolimnesia schadei LUNDBLAD 1938. Zool. Anz. **122**: 9; LUNDBLAD 1941. Svensk. Vetenskapsakad. Handling **19**(7): 164; LUNDBLAD 1953. Ark. Zool. **5**(8): 486; VIETS 1954b. Schweiz. Zeitschr. Hydrologie **16**(1): 119; VIETS & BÖTTGER 1986. Stud. Neotrop. Fauna Environ. **21**(1-2): 111. These specimens from Paraguay agree well with the type material of LUNDBLAD from Brazil and Paraguay (1938, 1941); the specimens taken by VIETS (1954b) in Amazonas (Brazil) exhibit slight differences in measurements, their body, for instance, is larger.

Material examined: 22 males and 58 females from 'Hy 3' and 'Hy 4'.

***Centrolimnesia guarani* new species**

Male: Length of body 789, width 628; dorsum with a pair of irregular and small platelets at posterior end, 69 in length and 16 in width; length between anterior end of the first coxae and posterior end of the fourth coxae 562; width between lateral margins of the fourth coxae 570; medial margins of the first coxae long; Glandula Limnesiae located anteromedially on fourth coxae; genital field 181 in length and 142 in width; gonopore occupying much more than half the area of genital field; numerous thin and long setae along the edge of genital field; three pairs of irregularly shaped acetabula; Fig. 10 illustrates the structure of ventral side; dorsal side of palp with numerous pilose setae and ventral side of P-II bulk with small peg-like setae; dorsal lengths of the palpal segments: P-I: 14; P-II: 56; P-III: 62; P-IV: 87; P-V: 30; chelicera 198 in length; capitulum 165 in length; structure of palp illustrated in Fig. 16; dorsal lengths of the distal segments of the first leg: I-leg-4: 142; I-leg-5: 157; I-leg-6: 130; I-leg-4 and 5 with numerous pilose and long setae; dorsal lengths of the distal segments of the third leg: III-leg-3: 148; III-leg-4: 177; III-leg-5: 251; III-leg-6: 164; III-leg-3 with four swimming hairs; III-leg-4 with eight swimming hairs and numerous pilose, long setae; III-leg-5 with six swimming hairs and numerous long, pilose hairs on ventral side; dorsodistal end of this segment projecting far beyond the insertion of the sixth segment; III-leg-6 with a curved line of short, heavy setae which are much longer at the dorsal distal end; the margin of ventral distal end of III-leg-6 in Fig. 11; dorsal lengths of the distal segments of fourth leg: IV-leg-3: 230; IV-leg-4: 193; IV-leg-5: 218; IV-leg-6: 317; IV-leg-3 with five swimming hairs; IV-leg-4 and 5 with seven swimming hairs; IV-leg-6 curved and with numerous small setae (Fig. 12).

Female: length of body 743 (760-772), width 536 (520-540); dorsum with a pair of small platelets medially fused or not; length between anterior end of the first coxae and posterior end of fourth coxae 504 (520-529); genital field 164 (162-173) in length; 152 (148-154) in width; acetabula small and with few thin hairs (Fig. 15); ovigerous females with eggs of 144 diameter; dorsal lengths of the palpal segments: P-I: 17 (15-19); P-II: 60 (62-68); P-III: 54 (53-58); P-IV: 89 (90-96); P-V: 23 (22-24); chelicera: 196 (194-202); palp as described for the male; dorsal lengths of the distal segments of the third leg: III-leg-4: 155 (154-159); III-leg-5: 188 (185-216); III-leg-6: 137 (135-151); III-leg-4 with eight swimming hairs; III-leg-5 with eleven swimming hairs; Fig. 13 illustrates the proportions and chaetotaxy of III-leg-5 and 6; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 161 (160-163); IV-leg-5: 188 (192-195); IV-leg-6: 191 (189-191); IV-leg-4 and 5 with eight swimming hairs (Fig. 14).

Holotype: Adult male from 'Hy 5'.

Allotype: Adult female from 'Hy 5'.

Material examined: 3 gravid females from 'Hy 5'.

Discussion: There are two species most closely related to *C. guarani* n. sp.: *C. vietsi* LUNDBLAD 1941 (from Paraguay) and *C. motasi* COOK 1980 (from Mexico). However, the new species differs in structure and chaetotaxy of the third and fourth legs of the male; in *C. guarani* the hairs of III-leg-5 are longer and more numerous and bear two 'spatulate bipectinate' setae at the distal end; III-leg-6 of *C. guarani* n. sp. male has several curved, short and heavy setae which are longer at the distal end and a pair of 'spatulate bipectinate' setae at the distoventral side (see Fig. 11); these are very distinctive diagnostic characters for *C. guarani* n. sp.

Family Unionicolidae OUDEMANS

Genus *Unionicola* HALDEMAN

In Paraguay about ten species of the genus *Unionicola* have previously been recorded; *U. fissipalpis* is one of them.

Unionicola (Pentatax) fissipalpis LUNDBLAD 1942; *Unionicola (Pentatax) fissipalpis* LUNDBLAD 1942. Svensk. Vetenskapsakad. Handling **20**(2): 119; VIETS 1954a. Arch. Hydrobiol. **49**(1-2): 85; VIETS 1954b. Schweiz. Zeitschr. Hydrologie **16**(1): 128; VIETS & BÖTTGER 1986. Stud. Neotrop. Fauna Environ. **21**(1-2): 112.

The present study agrees well with the description by LUNDBLAD and the more recent paper of VIETS & BÖTTGER (1986).

Material examined: 1 male from 'Hy 4'; 1 male from 'Hy 5'.

Genus *Neumania* LEBERT

Six species of the genus *Neumania* have been known from Paraguay, one of them is *N. polytricha* LUNDBLAD 1938.

***Neumania (Tetraneumania) polytricha* LUNDBLAD 1938**

Neumania polytricha LUNDBLAD 1938. Zool. Anz. **122**: 12; *N. (Tetraneumania) polytricha* LUNDBLAD 1942. Svensk. Vetenskapsakad. Handling **20**(2): 160; VIETS 1954b. Schweiz. Zeitschr. Hydrologie **16**(1-2): 135.

Male: Body 563 in length, 430 in width; dorsal shield 238 in length, 288 in width; length between anterior end of the first coxae and posterior end of the fourth coxae 432; gonopore 82 in length; dorsal lengths of the palpal segments: P-I: 29; P-II: 93; P-III: 52; P-IV: 97; P-V: 32; chelicera 130 in length; dorsal lengths of the distal segments of the first leg: I-leg-4: 185; I-leg-5: 173; I-leg-6: 214; dorsal lengths of the distal segments of the second leg: II-leg-4: 181; II-leg-5: 181; II-leg-6: 243; dorsal lengths of the distal segments of the third leg: III-leg-4: 156; III-leg-5: 177; III-leg-6: 189; dorsal lengths of

the distal segments of the fourth leg: IV-leg-4: 159; IV-leg-5: 196; IV-leg-6: 170; IV-leg-4 with five swimming hairs; IV-leg-5 with seven swimming hairs.

Material examined: 1 male from 'Hy 4'.

Discussion: The specimen agrees well with the description and redescription by LUNDBLAD (1938, 1942) and is only included in here for the sake of completeness.

Genus *Koenikea* WOLCOTT

LUNDBLAD (1943a) published approximately 30 species and subspecies of *Koenikea* from Paraguay and VIETS & BÖTTGER (1986) added information about four species. In the present studies there are found two new species. For some further species of *Koenikea* there are given some morphological variations.

Koenikea (Koenikea) triangularis LUNDBLAD 1938

Koenikea triangularis LUNDBLAD 1938. Zool. Anz. **122**: 13; *Koenikea* (s. str.) *triangularis* LUNDBLAD 1943a. Svensk. Vetenskapsakad. Handling **20**(5): 122.

Female: Body 549-644 in length, 520-644 in width; dorsal and ventral shields present; dorsal shield 479-553 in length, 450-512 in width; arrangement of the dorsal glandularia slightly different from male in LUNDBLAD's maps (1943a) (glandularia 5 are located far posterolaterally to the third pair); Fig. 18 illustrates the dorsal shield; length between anterior end of the first coxae and posterior end of the fourth coxae 275-347; width between lateral margins of fourth coxae 341-368; genital field 337-351 in width; genital flaps 124-149 in length, 86-111 in width; dorsal lengths of the palpal segments: P-I: 28-29; P-II: 62-82; P-III: 33-41; P-IV: 58-77; P-V: 35-37; capitulum 103-116 in length; chelicera 111-125 in length; palpal segments with several relatively long and pilose setae (Fig. 17); dorsal lengths of the distal segments of the first leg: I-leg-4: 80-111; I-leg-5: 91-126; I-leg-6: 82-109; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 124-142; IV-leg-5: 138-171; IV-leg-6: 124-150; III-leg-4 and 5 with three swimming hairs each; IV-leg-4 with five or six swimming hairs; IV-leg-5 with three or four swimming hairs.

Material examined: 3 females from 'Hy 1'; 1 female from 'Hy 2'; 60 females from 'Hy 3'; 1 female from 'Hy 5'.

Koenikea (Koenikea) acuta acuta LUNDBLAD 1943

Koenikea (s. str.) *acuta* LUNDBLAD 1943a. Svensk. Vetenskapsakad. Handling **20**(5): 124.

Male: Dorsal and ventral shields present; dorsal furrow complete; dorsal shield 407-413 in length, 407-416 in width; length between anterior end of first coxae and posterior end of fourth coxae 267-272; width between lateral margins of fourth coxae 317-321; acetabular field 310 in width; gonopore 82 in length; 45-50 genital acetabula on each side; dorsal lengths of the palpal segments: P-I: 23-31; P-II: 64-65; P-III: 31; P-IV: 58-62; P-V: 33; palp with several long setae illustrated in Fig. 19; dorsal lengths of the distal segments of the first leg: I-leg-4: 82-83; I-leg-5: 99-101; I-leg-6: 93-94; I-leg-6 with a long thin seta; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 107-112; IV-leg-5: 124-125; IV-leg-6: 113-114; I-leg-5 with two swimming hairs; IV-leg-4 with four to five swimming hairs; IV-leg-5 with eight to ten swimming hairs.

Female: Length of body 549-578, width 504-549; dorsal and ventral shields present; dorsal shield 483-549 in length, 446-479 in width; length between anterior end of the

first coxae and posterior end of the fourth coxae 271-274; width between lateral apophyses of the fourth coxae 325-331; width of the genital field 325; gonopore flaps 136 in length, 107 in width; dorsal lengths of the palpal segments: P-I: 23; P-II: 68-70; P-III: 31; P-IV: 58-60; P-V: 33-34; palpal chaetotaxy as described for the male; dorsal lengths of the distal segments of the first leg: I-leg-4: 78-79; I-leg-5: 93-94; I-leg-6: 85-87; dorsal lengths of distal segments of the fourth leg: IV-leg-4: 117-119; IV-leg-5: 134-138; IV-leg-6: 113-115; I-leg-5 and IV-leg-4 with two swimming hairs; IV-leg-5 with three swimming hairs.

Material examined: 1 male and 1 female from 'Hy 2'; 4 females and 1 male from 'Hy 4'; 1 female from 'Hy 5' and 3 females from 'Hy 6'.

Discussion: LUNDBLAD described this species from the South of Paraguay. The present specimens agree well with the description by LUNDBLAD except for palpal chaetotaxy. Refering to this characteristic it is more closely related to *K. acuta dentata* VIETS 1975 (described by VIETS from Amazonas, Brazil).

Koenikea (Koenikea) paraguayensis new species

Male: Body 624 (603-677) in length, 671 (644-677) in width; dorsal and ventral shields present; dorsal furrow complete; dorsal shield 570 (430-553) in length; 599 (404-620) in width; dorsum with six pairs of glandularia and the color pattern as shown in Fig. 20; body larger and postolaterally angular (see Fig. 20); length from anterior end of the first coxae to posterior end of the fourth coxae 417 (321-413); width between lateral margins of fourth coxae 392 (304-392); posterior apodemes of anterior coxal groups short; acetabular region 308 (292-308) in width; gonopore 84 (87-88) in length, 31 (29-38) in width; 45-50 (40-48) genital acetabula on each side; Fig. 21 shows the structure of the venter; excretory pore subterminal; capitulum with small rostrum and 135 (139) in length; dorsal lengths of the palpal segments: P-I: 31 (31); P-II: 104 (97-106); P-III: 52 (53-55); P-IV: 107 (103-107); P-V: 52 (50-53); peg-like seta of P-IV stubby and inserted distoventrally; ventral surfaces of P-II and P-III rugose; Fig. 24 shows a palp; dorsal lengths of the distal segments of the first leg: I-leg-4: 166 (152); I-leg-5: 166 (154); I-leg-6: 144 (146); with few and short 'rillborsten' on I-leg-4 and 5; dorsal lengths of the distal segments of the third leg: III-leg-4: 105; III-leg-5: 166; III-leg-6: 144; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 160 (152); IV-leg-5: 222 (218); IV-leg-6: 181 (185); distoventral side of IV-leg-4 with six swimming hairs and palmate seta; IV-leg-5 ventral side with a series of long and short, thickened, pilose setae and six (five) swimming hairs; IV-leg-6 with four (five) short, pilose, truncate hairs (Fig. 22).

Female: Length of body 768 (768-785), width 785 (710-814); dorsal and ventral shields present; dorsal furrow complete; dorsal shield 694 (702-719) in length, 661 (611-740) in width; the pigment patches on the dorsal shield bigger than in the male (Fig. 23); outline oval, not angular and wider than in the male; length from anterior end of the first coxae to posterior end of the fourth coxae 446 (443-458); width between lateral margins of the fourth coxae 458 (456-479); genital field 384 (381-388) in width; genital flaps 124 (124-127) in length and 124 (124-126) in width; aproximately 50 genital acetabula (48-51) on each side; dorsal lengths of the palpal segments: P-I: 38 (31-39); P-II: 111 (106-113); P-III: 66 (56-64); P-IV: 120 (113-115); P-V: 54 (49-58); proportions and chaetotaxy of the palp are similar to the male; capitulum 136 (134-152) in length; dorsal lengths of the distal segments of the first leg: I-leg-4: 188 (189-192);

I-leg-5: 169 (165-172); I-leg-6: 144 (136-142); with a few 'rillborsten' on I-leg-4 and 5; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 191 (189-195); IV-leg-5: 241 (243-250); IV-leg-6: 212 (210-214); chaetotaxy as in the male, except that IV-leg-6 has longer pilose hairs.

Holotype: Adult male from 'Hy 3'.

Allotype: Adult female from 'Hy 3'.

Material examined: 2 females from 'Hy 1'; 2 females from 'Hy 2'; 2 males and 1 female from 'Hy 3'; 1 male from 'Hy 4'; 2 females from 'Hy 6'.

Discussion: Concerning the wider and posterolaterally angular shape of the body the male of *K. (Koenikea) paraguayensis* n. sp. seems most closely related to *K. (K.) bicornis* LUNDBLAD 1941 (from Paraguay); *K. (K.) falcaria* VIETS 1977 (from Brazil); *K. (Notomideopsis) spinosa* DADAY 1905 (from Paraguay and Brazil) and *K. (Notomideopsis) toloma* COOK 1980 (from Mexico). The new species differs in the posterior apodemes of the anterior coxal groups, in the arrangement of the glandularia in the dorsal shield and in the genital field extending farther to the posterior margin of the ventral shield. Furthermore *K. toloma* bears enlarged claws in the IV-leg-6 and a spatulate seta in the ventral surface; *K. falcaria* has a strongly modified IV-leg-6, not found in the new species. *K. paraguayensis* has a color pattern which is very different from the four mentioned species. The female of the new species is very similar to the female of *K. quinquemaculata* LUNDBLAD 1943a (from Paraguay) and *K. sexmaculata* COOK 1980 (from Mexico); however, the best characteristics to distinguish *K. paraguayensis* are the color pattern and the genital field.

***Koenikea (Koenikea) retrocornuta* new species**

Male: Body 529 in length, 492 in width; dorsal and ventral shields present; dorsal furrow complete; dorsal shield 492 in length, 421 in width; a pair of posterolated horn-like projections with 'enlarged glandularia' located in their base; the other pairs of glandularia on the tubercles (Fig. 25); length from anterior end of the first coxae to posterior end of fourth coxae 304; width between lateral apophyses of fourth coxae 321; posterior apodemes of anterior coxal groups short; gonopore 95 in length; genital field 251 in width; 23 acetabula on each side and a moderately enlarged glandularia, illustrated in Fig. 26; excretory pore subterminal; dorsal lengths of the palpal segments: P-I: 24; P-II: 76; P-III: 41; P-IV: 62; P-V: 37; capitulum 111 in length; chelicera 113 in length; peg-like seta on P-IV located at the ventral distal end; capitulum with short rostrum (Fig. 27); dorsal lengths of the distal segments of the first leg: I-leg-4: 83; I-leg-5: 102; I-leg-6: 113; I-leg-6 with numerous setae (Fig. 30); dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 126; IV-leg-5: 150; IV-leg-6: 149; IV-leg-4 with three swimming hairs; IV-leg-5 with three swimming hairs and pilose hairs on the ventral side of both segments as shown in Fig. 28.

Female: Body 587 (566-628) in length, 578 (560-601) in width; dorsal and ventral shields present, dorsal furrow complete; dorsal shield 537 (518-562) in length, 475 (459-500) in width; dorsal glandularia similar to that of the male but without any horn-like projections; length from anterior end of the first coxae to posterior end of fourth coxae 323 (314-352); width between lateral apophyses of fourth coxae 354 (349-378); posterior apodemes of anterior coxal groups short; gonopore flaps 132 (127-152) in length; genital field 304 (306-321) in width; 19-21 acetabula on each side (Fig. 29); dorsal lengths of the palpal segments: P-I 31 (28-37); P-II: 100 (96-106); P-III: 43 (41-47); P-

IV: 66 (62-70); P-V: 52 (49-56); capitulum 103 (105-113) in length; structure of palp, chelicera and capitulum as described for the male; dorsal lengths of the distal segments of the first leg: I-leg-4: 105 (93-113); I-leg-5: 122 (119-130); I-leg-6: 120 (113-122); chaetotaxy as in the male; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 146 (142-159); IV-leg-5: 167 (160-181); IV-leg-6: 134 (124-146); IV-leg-4 with five swimming hairs; IV-leg-5 with three swimming hairs and two smaller ones; the other hairs as in the male.

Holotype: Adult male from 'Hy 6'.

Allotype: Adult female from 'Hy 6'.

Material examined: 1 female from 'Hy 1'; 1 female from 'Hy 3'; 6 females from 'Hy 5'; 19 females from 'Hy 6'.

Discussion: There are three species of *Koenikea* with enlarged apophyses on the posterior shield: *K. rutae* LUNDBLAD (from south of Brazil); *K. siolii* VIETS (from Amazonas) and *K. consimilis* VIETS (from Amazonas). The new species, however, bears a single and unusual pair of posterolateral 'horn-like' projections with five glandularia, by which it can be easily distinguished. Furthermore *K. rutae, K. siolii* and *K. consimilis* bear more than one pair of apophyses.

***Koenikea (Notomideopsis) spinosa* DADAY 1905**

See VIETS (1987) for the synonymy of this species.

The specimens redescribed and illustrated from Brazil by LUNDBLAD (1943a) and from Paraguay by VIETS & BÖTTGER (1986) agree with the specimens reported here.

Material examined: 2 females from 'Hy 2'; 2 females from 'Hy 3'; 17 females and 3 males from 'Hy 5'; 1 female from 'Hy 6'.

Koenikea (Notomideopsis) elegans* LUNDBLAD 1938; *Koenikea elegans

LUNDBLAD 1938. Zool. Anz. **122**: 12; *K.* (s. str.) *elegans* LUNDBLAD 1943a. Svensk. Vetenskapsakad. Handling **20**(5): 92; *K. (Notomideopsis) elegans* COOK 1980. Mem. Amer. Ent. Inst. **31**: 206.

Male: Length of body 735-752; width 793-841; dorsal and ventral shields present; dorsal furrow complete; dorsal shield 677-691 in length; 669-678 in width; glandularia on the dorsal shield as shown in Fig. 31; length between anterior end of first coxae and posterior end of the fourth coxae 545-560; width between lateral margins of fourth coxae 587-601; posterior apodemes of anterior coxal group extending posteriorly to the suture line between the third and fourth coxae; genital field 493-512 in width; 30-40 genital acetabula on each side; gonopore 107-111 in length; 41-45 in width; excretory pore terminal; dorsal lengths of the palpal segments: P-I: 30-31; P-II: 107-110; P-III: 72-74; P-IV: 124-126; P-V: 47-49; palpal setae pilose, Fig. 33 illustrates a lateral view of the palp; capitulum 144 in length; dorsal lengths of the distal segments of the first leg: I-leg-4: 210-302; I-leg-5: 222; I-leg-6: 230-231; I-leg-2-3-4 and 5 with 'rillborsten' of different size (Fig. 32); dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 210-211; IV-leg-5: 263-265; IV-leg-6: 201-204; IV-leg-4 with six or eight swimming hairs; IV-leg-5 with four swimming hairs.

Female: Length of body 876-884, width 876-879; dorsal and ventral shields present; dorsal furrow complete; dorsal shield 818-822 in length, 760-762 in width; length between anterior end of first coxae and posterior end of fourth coxae 587-590; width between lateral margins of fourth coxae 636-654; genital field 504-513 in width; genital

flaps 140-150 in length and 124-128 in width; eight females with numerous eggs of 128-132 of diameter; dorsal lengths of palpal segments; P-I: 35-37; P-II: 107-113; P-III: 70-74; P-IV: 111-120; P-V: 47-49; palpal chaetotaxy as in the male; capitulum 134-139 in length; dorsal lengths of the distal segments of the first leg: I-leg-4: 216-226; I-leg-5: 199-201; I-leg-6: 198-206; with 'rillborsten' on segments I-leg-2 to 5; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 226-230; IV-leg-5: 267-273; IV-leg-6: 243-249; IV-leg-5 with 7 or 8 swimming hairs.

Material examined: 4 males and 8 females from 'Hy 2'; 2 females from 'Hy 4'.

Discussion: These specimens agree well with the material of LUNDBLAD from Southern Paraguay. Some additional measurements and the morphology of the body are given here.

***Koenikea (Diplokoenikea) curvirostris* WALTER 1919**

Koenikea curvirostris WALTER 1919. Rev. Suisse Zool. **27**: 45; *Koenikea flagellata* LUNDBLAD 1938. Zool. Anz. **122**: 14; *Koenikea (Diplokoenikea) curvirostris* LUNDBLAD 1943a. Svensk. Vetenskapsakad. Handling **20**(5): 45.

Female: Length of body 537, width 553; dorsal shield 496 in length, 454 in width (Fig. 34); length between anterior end of first coxae and posterior end of fourth coxae 300; width between lateral margins of fourth coxae 356; genital field 354 in width; genital flaps 132 in length, 70 in width; approximately 30 genital acetabula on each side; with several eggs of 192 diameter; dorsal lengths of the palpal segments: P-I: 31; P-II: 77; P-III: 37; P-IV: 75; P-V: 43; capitulum 111 in length (Fig. 35); dorsal lengths of the distal segments of the first leg: I-leg-4: 124; I-leg-5: 140; I-leg-6: 124; dorsal lengths of the distal segments of the third leg: III-leg-4: 109; III-leg-5: 155; III-leg-6: 140; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 140; IV-leg-5: 183; IV-leg-6: 148; IV-leg-4 with five swimming hairs; IV-leg-5 with three swimming hairs (Fig. 36).

Material examined: 1 female from 'Hy 3'.

Discussion: The present species agrees well with LUNDBLAD's material; some new morphological details and measurements are given for this species.

Genus *Recifella* (VIETS)

Recifella was described as a subgenus of *Koenikea*; COOK (1980) elevated it to genus. Several *Koenikea* species were transferred to *Recifella*. In Paraguay there are about 12 species and subspecies of this genus; two of them are found in this study.

***Recifella (Eorecifella) excavata* (LUNDBLAD 1936)**

Koenikea excavata LUNDBLAD 1936. Zool. Anz. **116**: 16; *K. (Koenikea) excavata* LUNDBLAD 1943a. Svensk. Vetenskapsakad. Handling **20**(5): 88; *Recifella (Eorecifella) excavata* COOK 1980. Mem. Amer. Ent. Inst. **31**: 201.

Female: Length of body 463, width 413; dorsal and ventral shields present; dorsal furrow complete; dorsal shield 413 in length, 380 in width; subcuticular lines are very noticeable by extending laterally between glandularia; three pairs of glandularia present on dorsal shield; Fig. 36 illustrates the dorsal shield; length between anterior end of the first coxae and posterior end of fourth coxae 267; width between lateral tips of fourth coxae 314; posterior apodemes of anterior coxal groups extending near to the suture lines between third and fourth coxae 267; acetabular plates 247 in width; gonopore flaps

58 in length and 42 in width; 24-26 genital acetabula each side; excretory pore subterminal (Fig. 38); dorsal lengths of the palpal segments: P-I: 21; P-II: 56; P-III: 33; P-IV: 62; P-V: 27; chelicera 93 in length; several tubercles with setae on ventral side of P-IV (Fig. 37); dorsal lengths of the segments of the first leg: I-leg-4: 120; I-leg-5: 113; I-leg-6: 113; first leg with numerous 'rillborsten' (Fig. 39); dorsal lengths of the segments of the fourth leg: IV-leg-4: 126; IV-leg-5: 142; IV-leg-6: 113; all segments with numerous short, pilose hairs getting longer on distal segments; IV-leg-5 with four swimming hairs.

Material examined: 1 female from 'Hy 2'.

***Recifella (Eorecifella) undulata* (LUNDBLAD 1936)**

Koenikea (Koenikea) undulata LUNDBLAD 1936. Zool. Anz. **116**: 201; *K.* (s. str.) *undulata* LUNDBLAD 1943a. Svensk. Vetenskapsakad. Handling **20**(5): 89; *Recifella (Eorecifella) undulata* COOK 1980. Mem. Amer. Ent. Inst. **31**: 201.

Female: Dorsal and ventral shields present; dorsal furrow complete; dorsal shield 477 in length; 388 in width; three pairs of glandularia present on dorsal shield, of which the most anterior lie on tubercles; length between anterior end of first coxae and posterior end of fourth coxae 390 and 397 in width between lateral fourth coxae; genital acetabula free and more than 50; gonopore terminal and 142 in length and 101 in width; dorsal lengths of the palpal segments: P-I: 27; P-II: 93; P-III: 43; P-IV: 72; P-V: 29; ventral side of P-II and P-III with very small denticles, Fig. 40 illustrates the morphology and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-leg-4: 124; I-leg-5: 126; I-leg-6: 115; I-leg-4 and 5 with several 'rillborsten' (Fig. 41); dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 99; IV-leg-5: 97; IV-leg-6: 105; IV-leg-4 with four or five swimming hairs; IV-leg-5 with three swimming hairs.

Material examined: 1 female from 'Hy 1'.

Discussion: The present specimens have small denticles and more pilose hairs on P-II and P-III than in LUNDBLAD's diagnosis, but otherwise they are similar.

Family Pionidae KOCH

Genus *Piona* KOCH

Seven species of *Piona* have been known from Paraguay to date (LUNDBLAD 1943b; VIETS & BÖTTGER 1986); in the present paper a new species is described: *Piona davidkooki* n. sp.; *Piona deformis* LUNDBLAD 1941 is mentioned for the first time from Paraguay.

***Piona deformis* LUNDBLAD 1941**

Piona deformis LUNDBLAD 1941. Ent. Tidskr. **62**: 124; 1941. Svensk. Vetenskapsakad. Handling **20**(8): 10; SMITH 1976. Can. Ent. **108**: 994.

Male: Body with a very particular shape; Figs. 42 and 43 illustrate a dorsal and lateral view; length of body 454-471, width 355-363; with a pair of dorsal platelets: 39 in length and 27 in width; anterior coxal groups separated medially; tips of first coxae extending beyond the capitulum; suture lines between third and fourth coxae medially incomplete; third and fourth coxae fused medially but not complete; length between

anterior end of the first coxae and posterior end of fourth coxae 408-440; width between lateral tips of fourth coxae 412-473; genital field fused with the fourth coxae and extending as far as posterior corners of these; gonopore lying in a slight depression, and excretory pore attached to the genital field, as shown in Fig. 44; gonopore 287 in length, 10 in width; 15-17 genital acetabula on each side; capitulum 156 in length; dorsal lengths of the palpal segments: P-I: 31; P-II: 144-175; P-III: 72-91; P-IV: 134-173; P-V: 39-52; P-IV with a very small peg-like seta; Fig. 47 illustrates the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-leg-4: 72-75; I-leg-5: 185-187; I-leg-6: 156-160; I-leg-6 with many small setae; dorsal lengths of the distal segments of the third leg: III-leg-4: 189-192; III-leg-5: 226-231; III-leg-6: 99-100; long claw of third leg with a short and wide clawlet shown in Fig. 48; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 189-214; IV-leg-5: 201-277; IV-leg-6: 123-173; IV-leg-4 as shown in Fig. 45; IV-leg-5 with four swimming hairs; IV-leg-4 with three swimming hairs.

Female: Length of body 611-644, width 504-537; pair of dorsal platelets, 49 in length, 19 in width; length between anterior end of the first coxae and posterior end of fourth coxae 363; width 677; all coxal groups separated; posterior corners of fourth coxae moderately projecting; suture lines between third and fourth coxae incomplete; acetabular plates complete but several acetabula free; more than 30 acetabula on each side; length between pre- and postgenital sclerites 169; acetabular plate 218 in width; Fig. 46 illustrates the venter; dorsal lengths of the palpal segments: P-I: 27; P-II: 124-127; P-III: 62-65; P-IV: 124-131; P-V: 37-39; lengths of the distal segments of the first leg: I-leg-4: 123; I-leg-5: 144; I-leg-6: 152; lengths of the distal segments of the fourth leg: IV-leg-4: 180; IV-leg-5: 193; IV-leg-6: 189; IV-leg-5 with three swimming hairs.

Material examined: 2 males and 2 females from 'Hy 2'; 2 females from 'Hy 4'.

Discussion: Previously *Piona deformis* was known from Río Grande do Sul, Brazil; so this is a new record to Paraguay. The specimens agree well with the structure and proportional lengths of the original description; by this study several data is added.

***Piona davidcooki* new species**

Male: Body 1942 in length, 1042 in width; length between anterior end of first coxae and posterior end of fourth coxae 950; width between lateral margins of fourth coxae 1024; anterior coxal groups separated medially; third and fourth coxae fused medially; Fig. 49 shows a ventral view; suture lines between third and fourth coxae fused medially; posterior margins of fourth coxae not projecting; genital field extending laterally to posterior projection of fourth coxae; gonopore 82 in length and 29 in width; two epimeroglandularia in genital gield; more than 30 acetabula of different sizes on each side; excretory pore attached to genital field; Fig. 51 illustrates the genital field; ejaculatory complex is shown in Fig. 52; ventral side of P-IV with a pair of well developed tubercles bearing numerous different setae; dorsal lengths of the palpal segments; P-I: 70; P-II: 329; P-III: 185; P-IV: 354; P-V: 99; Fig. 54 shows the chaetotaxy and proportions of the palp; chelicera 292 in length; dorsal lengths of the distal segments of the third leg: III-leg-4: 446; III-leg-5: 438; III-leg-6: 190; III-leg-4 with eleven swimming hairs; dorsal distal end of III-leg-6 enlarged; long claw of third leg with a very long clawlet, Fig. 53 illustrates III-leg-5 and 6; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 430; IV-leg-5: 538; VI-leg-6: 426; Fig. 55 shows

the structure of IV-leg-4; IV-leg-5 with four swimming hairs.

Female: Length between anterior end of first coxae and posterior end of fourth coxae 958; width between lateral margins of fourth coxae 1312; all coxal groups separated; posterior lines of fourth coxae slightly projecting; suture lines between third and fourth coxae ending slightly before medial margins; Fig. 50 illustrates the ventral sclerites; pregenital sclerite between posteromedial margins of fourth coxae; length between margins of pre- and postgenital sclerites 330; width of genital field 694; more than 30 genital acetabula; acetabular plate more than two acetabula in width; several acetabula free; P-IV with tubercles but smaller than in the male; dorsal lengths of the palpal segments: P-I: 29; P-II: 171; P-III: 72; P-IV: 163; P-V: 49; dorsal lengths of the distal segments of the first leg: I-leg-4: 206; I-leg-5: 218; I-leg-6: 189; dorsal lengths of the distal segments of the third leg: III-leg-5: 234; III-leg-6: 185; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 222; IV-leg-5: 259; IV-leg-6: 194; III-leg-5 with twelve swimming hairs; IV-leg-4 with five swimming hairs; female with several eggs of approximately 220 in diameter.

Holotype: Adult male from 'Hy 2'.

Allotype: Adult female from 'Hy 2'.

Discussion: The present species resembles: *Piona juncta* LUNDBLAD 1936 (described from southern Brazil); *P. juncta inconspicua* LUNDBLAD 1943b (known from Paraguay); *P. robustipalpis* VIETS 1954a (from north of Brazil) and *P. junctella* COOK 1980 (described from specimens of Costa Rica), however, the male of the new species differs in several ways from all of them. One of the differences concerns the proportions of the spermathophore transferring claw of the third leg; other differences are: the genital field fused medially with the fourth coxae; more than 30 acetabula of different size on each side; small gonopore; excretory pore fused with genital field; ventral side of P-IV with large tubercles and numerous setae.

Family Mideopsidae KOENIKE

Genus *Mideopsis* NEUMAN

Six species of *Mideopsis* are known from Paraguay. *M. sica* is new for the Paraguayan water mites fauna.

***Mideopsis (Neoxystonotus) sica* LUNDBLAD 1943**

Mideopsis (Neoxystonotus) sica LUNDBLAD 1943b. Svensk. Vetenskapsakad. Handling **20**(8): 130.

Female: Length of body 594-604, width 570-580; dorsal shield 512-522 in length, 471-485 in width; dorsal shield with O-shaped, pore-free area; color pattern with green areas, one anterior spot and 2 pairs of lateral patches (Fig. 56); length between anterior end of first coxae to posterior end of fourth coxae 399-409; width between lateral margins of fourth coxae 370-382; gonopore length 123-127; width 86-88; dorsal lengths of the palpal segments: P-I: 31-33; P-II: 52-57; P-III: 25-27; P-IV: 64-69; P-V: 27-29; Fig. 58 illustrates the structure of the palp; capitulum 93-100 in length; dorsal lengths of the distal segments of the first leg: I-leg-4: 78-82; I-leg-5: 103-109; I-leg-6: 95-100; dorsal lengths of the distal segments of the second leg: II-leg-4: 87-89; II-leg-5: 101-103; II-leg-6: 93-96; dorsal lengths of the distal segments of the third leg: III-leg-4:

103-105; III-leg-5: 130-134; III-leg-6: 113-116; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 115-122; IV-leg-5: 127-132; IV-leg-6: 134-140; IV-leg-4 with six swimming hairs; IV-leg-5 with seven swimming hairs (Fig. 57).

Material examined: 2 females from 'Hy 4'.

Discussion: The present specimens agree well with the description by LUNDBLAD (1943b) from Brazil; the morphological characteristics, the color pattern and the measurements yet unknown are included.

Family Arrenuridae THOR

Genus *Arrenurus* DUGÈS

***Arrenurus (Dadayella)* (KOENIKE 1907)**

Six species belonging to this subgenus have been collected in Paraguay, among which are *Arrenurus (Dadayella) rotunda* (DADAY 1905) and *A. (Dadayella ?) nanus* (VIETS 1954a) (CRAMER & COOK 1992b).

***Arrenurus (Dadayella) rotunda* (DADAY 1905)**

See VIETS (1987) for the involved synonymy; CRAMER & COOK 1992b. Int. J. Acarol. **18**(3): 221.

Material examined: 13 females from 'Hy 1'.

Discussion: These specimens agree well with the redescription by VIETS (1954a) and ROSSO DE FERRADÁS (1981).

***Arrenurus (Dadayella ?) nanus* (VIETS 1954a)**

Arrenurus (Truncaturus) nanus VIETS 1954a. Arch. Hydrobiol. **49**(1-2): 189; 1954b. Schweiz. Zeitschr. Hydrologie **16**(1): 208; ROSSO DE FERRADÁS 1981. Rev. Soc. Ent. Argentina **40**(1-2): 194; *A. (Dadayella ?) nanus* CRAMER & COOK 1992b. Int. J. Acarol. **18**(3): 221.

Material examined: 2 males from 'Hy 2'.

Discussion: These two males agree with the specimens of ROSSO DE FERRADÁS (1981) from Argentina in all aspects.

Arrenurus (Megaluracarus)

The subgenus *Arrenurus (Megaluracarus)* with about 20 species is the second in species number for water mites in Paraguay; nine species of this subgenus are covered in this study. Four species are already known from Paraguay and had been described and redescribed very well because they are the most abundant in the Paraná basin: *Arrenurus (Megaluracarus) epimerosus* MARSHALL 1919; *A. (M.) triconicus* MARSHALL 1919; *A. (M.) cornifrons* LUNDBLAD 1938 and *A. (M.) crenicaudata* LUNDBLAD 1938 (ROSSO DE FERRADÁS 1984). For two other species this study reveals new records for Paraguay: *A. (M.) cataglyphus* and *A. (M.) fuhrmanni*; these species have been described and illustrated elsewhere (ROSSO DE FERRADÁS 1984, 1989). For this reason they are not included here and because they are also very frequent in the extent of the Paraná basin. The seventh species is *A. (M.) gladiiferus* LUNDBLAD, which is already known from Paraguay; here is included the first description of the

previously unknown female. At last two new species, *Arrenurus (Megaluracarus) bachmanni* n. sp. and *Arrenurus (Megaluracarus) funneliforme* n. sp. are described.

***Arrenurus (Megaluracarus) gladiiferus* LUNDBLAD 1941**

Arrenurus (Megaluracarus) gladiiferus LUNDBLAD 1941. Ent. Tidskr. **62**(1-2): 126; LUNDBLAD 1944. Svensk. Vetenskapsakad. Handling **20**(13): 59.

Female: Dorsal and ventral shields present; dorsal furrow complete; length of body 789, width 677; dorsal shield 642 in length, 580 in width; color pattern of the dorsum with three dark green patches; length between anterior end of first coxae and posterior end of fourth coxae 421 (438); width between lateral tips of fourth coxae 661 (681); acetabular plate region 148 (165) in length, 413 (436) in width; Fig. 59 illustrates a ventral view; dorsal lengths of the palpal segments: P-I: 27 (29); P-II: 68 (70); P-III: 37 (38); P-IV: 64 (67); P-V: 34 (37); Fig. 60 illustrates the chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-leg-4: 120 (129); I-leg-5: 130 (138); I-leg-6: 126 (132); dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 161 (170); IV-leg-5: 171 (179); IV-leg-6: 165 (173); IV-leg-4 with six swimming hairs in the distal end; IV-leg-5 with seven swimming hairs.

Material examined: 4 females from 'Hy 1'; three of them ovigerous.

Discussion: The palp of the females agree very well with the palp of the male with the characteristic patch of many 'blade-of-cutlass-like' setae in P-II.

***Arrenurus (Megaluracarus) bachmanni* new species**

Male: Body 1354 in length, 781 in width; cauda 615 in length, at the posterior end 385 in width; cauda long and widening to the posterior end and concave in the middle; cauda dorsally with a round hump (dorsal and lateral view in Figs. 61 and 64); anterior end of the body slightly projecting; dorsal portion of ventral shield with two anterior pairs of humps and a pair of posterolateral projections; dorsal furrow complete and passing ventrally at the base of cauda immediately posterior to the genital field; length between anterior end of the first coxae and posterior end of fourth coxae 653; width between lateral tips of the fourth coxae 818; length of the gonopore 58 (ventral view in Fig. 62); dorsal lengths of the palpal segments: P-I: 45; P-II: 127; P-III: 58; P-IV: 119; P-V: 58; medial surface of P-II with a large patch of setae of different kinds: 'blade-of-cutlass-like' and spatulate; internal surface with several pilose setae; Fig. 65 illustrates the chaetotaxy of palp; capitulum 169 in length; dorsal lengths of the distal segments of the first leg: I-leg-4: 181; I-leg-5: 212; I-leg-6: 259; I-leg-6 covered with large setae (Fig. 74); dorsal lengths of the distal segments of the second leg: II-leg-4: 226; II-leg-5: 255; II-leg-6: 280; II-leg-4 and 5 with seven swimming hairs; dorsal lengths of the distal segments of the third leg: III-leg-4: 230; III-leg-5: 255; III-leg-6: 243; III-leg-4 with eleven swimming hairs; III-leg-5 with eight swimming hairs, dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 329, with distal projection 354, and with six swimming hairs at the tip; IV-leg-5: 308, with three rows of swimming hairs with 10-15-10 hairs, respectively; IV-leg-6: 411, distal end slightly curved (Fig. 63).

Female: Body 1187 in length, 1104 in width; dorsal and ventral shields present; dorsal furrow complete; dorsal shield 792 in length, 615 in width; anterior margin of the body as in the male; with two pairs of projections on lateral margin (Fig. 69 illustrates the structure of the dorsal view); length between anterior end of the first coxae and posterior end of the fourth coxae 567 (537); width between lateral tips of fourth coxae

810 (859); genital field, 207 (185) in length, 615 (596) in width (Fig. 70); dorsal lengths of the palpal segments: P-I: 41 (38); P-II: 109 (103); P-III: 54 (52); P-IV: 124 (103); P-V: 52 (52); palp as in the male; capitulum 107 in length; chelicera 146 in length; dorsal lengths of the distal segments of the first leg: I-leg-4: 175 (169); I-leg-5: 179 (171); I-leg-6: 181 (185); dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 234 (201); IV-leg-5: 238 (249); IV-leg-6: 234 (243); IV-leg-4 with two rows of hairs each bearing nine to ten swimming hairs; IV-leg-5 with ten swimming hairs (Fig. 66).

Holotype: Adult male from 'Hy 2'.

Allotype: Adult female from 'Hy 2'.

Material examined: 1 male and 1 female from 'Hy 4'.

Discussion: *Arrenurus bachmanni* n. sp. has affinities to the species of the *expansus* group which is distributed from the Neotropical Region to the Southeast of the United-States: *A. (M.) alloespansus* (CRAMER & COOK 1992a (Mexico); *A. (M.) expansus* MARSHALL 1908 (Southeastern United States); *A. (M.) extensus* VIETS 1954a (Brazil); *A. (M.) neoexpansus* COOK 1980 (Mexico); *A. (M.) nuniesi* ORGHIDAN & GRUIA 1938 (Cuba); *A. (M.) quadrituberculatus* VIETS 1937, *A. (M.) expansiformis* LUNDBLAD 1938 (Brazil); the males of this group are characterized by posterolateral projections of the body, roundly pointed projections anterior to the eyes and a large setal patch on P-II. The present species has a stockier and more rounded dorsal hump on the cauda, which is very distinctive; only *A. (M.) neoexpansus* COOK has this characteristic, but is different in shape and smaller. The female of *A. bachmanni* has three pairs of projections which are very distinctive from other species.

***Arrenurus (Megaluracarus) funneliforme* new species**

Male: Body 694 (726) in length, 446 (470) in width; cauda long, 290 (305) in length and 182 (202) in width and narrowed at posterior end, with a large dorsal hump; posterior end of cauda round and angular and the last pair of glandularia not too close; a petiole absent; Fig. 72 illustrates a dorsal view and Fig. 67 a lateral view; dorsal furrow complete and ventrally extending immediately posterior to the acetabular plates; dorsal portion of the ventral shield relatively wide compared to body; length between anterior end of the first coxae and posterior end of the fourth coxae 341 (339); width between lateral apophyses of fourth coxae 460 (458); gonopore 66 (65) in length; posterior end of the cauda with a lateral concavity between dorsal and ventral surface, shaped like a funnel, including an excretory pore and the last pair of glandularia (Fig. 73); anterior external margins of second coxae very long; dorsal lengths of the palpal segments: P-I: 25 (25); P-II: 45 (47); P-III: 39 (38); P-IV: 60 (61); P-V: 41 (42); palp stocky with several long setae in distoventral portion (Fig. 68); capitulum 124 in length; dorsal lengths of the distal segments of the first leg: I-leg-4: 99 (103); I-leg-5: 97 (100); I-leg-6: 132 (136); I-leg-6 with numerous long hairs; dorsal lengths of the distal segments of the second leg: II-leg-4: 107 (105); II-leg-5: 107 (106); II-leg-6: 117 (118); dorsal lengths of the distal segments of the third leg: III-leg-4: 109 (115); III-leg-5: 111 (115); III-leg-6: 117 (119); III-leg-4 with seven swimming hairs; III-leg-5 with six swimming hairs; dorsal lengths of the distal segments of the fourth leg: IV-leg-4: 157 (165); IV-leg-5: 120 (126); IV-leg-6: 87 (89); distal end of the IV-leg-4 extending only very slightly beyond the insertion of IV-leg-5; IV-leg-4 and 5 with eleven swimming hairs (Fig. 71).

Female: Unknown.

Holotype: Adult male from 'Hy 1'.

Material examined: 1 male from 'Hy 1'.

Discussion: *A. (M.) funneliforme* n. sp. has an unusual concavity at the lateral posterior end of the cauda, shaped like a funnel, which is very distinctive.

Genus *Thoracaphoracarus* VIETS

In the Neotropical region, Southern Chile, this genus was previously known with two species: *T. (Thoracaphoracarus) simplex* COOK 1988 and *T. (Xenthoracaphorus) chilensis* COOK 1988; four female specimens were recollected in the present study and tentatively included in this genus, additional specimens will be needed before a final decision can be made.

Material examined: 2 females from 'Hy 4'; 2 females from 'Hy 6'.

Results and discussion

The six samples 'Hy 1' - 'Hy 6' from the five examined waters, one shallow lake and four ponds ('Tajamares') yielded altogether 29 species out of 13 genera and 8 families (see Table 2). 6 species are new to science.

Of the genus *Thoracaphoracarus* - hitherto in the neotropic region there were known just 2 species from the South of Chile (COOK 1988) - four females were caught; but determination at species level requires further material. Most species, namely 7, are of the genus *Koenikea*, followed by the genera *Arrenurus* with 5 species and *Limnesia* with 4 species. 7 of the 13 genera are represented just by 1 species; in the investigations of Paraguayan water mites by VIETS & BÖTTGER (1986) there were just 12 out of 16 genera.

The highest abundance is reached by *Limnesia polypora* (139 individuals), followed by *centrolimnesia schadei* (80 individuals) and *Koenikea triangularis* (65 individuals, exclusively females). In contrast, many species were found in very low abundance: Of 10 species just a single specimen could be caught. The distribution of the species over the five examined waters reveals striking differences (see Table 2). By far the largest number of species was recorded from the shallow lake: In the two samples 'Hy 1' and 'Hy 2' from two different shore regions 19 species were found; only two of them (*Koenikea triangularis* and *K. paraguayensis* n. sp.) occured in sample 'Hy 1' as well as in 'Hy 2'. Therefore more species could be recorded for the lake by further net catches.

For the four examined ponds, so-called Tajamares, the species number ranges from 5 (sample 'Hy 6') to 13 (sample 'Hy 4'). In the Tajamar of sample 'Hy 6' 10 species were recorded at the same season one year ago (see VIETS & BÖTTGER 1986, 'Fundort 4' with the sample of 19.07.1984); only two of them were sampled in both years, namely *Eylais protendens* and *Koenikea spinosa*. As for the shallow lake this finding indicates the necessity of further samples to record the species inventory completely, especially for different seasons. Certain fluctuations in the inventory of these neighbouring waters do exist, possibly depending on where the parasiting water mite larvae are transported by the respective host, imagines of merolimnic insects.

About one half of the species was recorded in one sampling site only. To which

Table 2: Compilation of Hydrachnidia species recorded in samples 'Hy 1' - 'Hy 6'.
The two samples 'Hy 1' and 'Hy 2' originate from the same water, a shallow lake.
The four remaining samples originate from respective different ponds, so-called Tajamares.
For *Eylais protendens* data about its sex is missing as only fragments of the specimen exist.

	Ind. (♂ - ♀)	Samples Hy 1	Hy 2	Hy 3	Hy 4	Hy 5	Hy 6
Eylaidae							
1. *Eylais protendens*	(1)			+			
Hydrodromidae							
2. *Hydrodroma peregrina*	(1- 22)	+		+	+	+	
Anisitsiellidae							
3. *Mamersellides ventriperforatus*	(1- 0)	+					
Limnesiidae							
4. *Limnesia laeta*	(1- 0)	+					
5. *Limnesia latigenitalis*	(0- 1)			+			
6. *Limnesia duricoria*	(1- 0)				+		
7. *Limnesia polypora*	(24-115)		+	+	+		
8. *Centrolimnesia schadei*	(22- 58)			+	+		
9. *Centrolimnesia guarani* n. sp.	(1- 3)					+	
Unionicolidae							
10. *Unionicola fissipalpis*	(2- 0)				+	+	
11. *Neumania polytricha*	(1- 0)				+		
12. *Koenikea triangularis*	(0- 65)	+	+	+		+	
13. *Koenikea acuta*	(2- 9)		+		+	+	+
14. *Koenikea paraguayensis* n. sp.	(3- 7)	+	+	+	+		+
15. *Koenikea retrocornuta* n. sp.	(1- 17)	+		+		+	+
16. *Koenikea spinosa*	(3- 22)		+	+		+	+
17. *Koenikea elegans*	(4- 10)		+		+		
18. *Koenikea curvirostris*	(0- 1)			+			
19. *Recifella excavata*	(0- 1)		+				
20. *Revifella undulata*	(0- 1)	+					
Pionidae							
21. *Piona deformis*	(2- 4)		+		+		
22. *Piona davidcooki* n. sp.	(1- 1)		+				
Mideopsidae							
23. *Mideopsis sica*	(0- 2)				+		
Arrenuridae							
24. *Arrenurus rotunda*	(0- 13)	+					
25. *Arrenurus nanus*	(2- 0)		+				
26. *Arrenurus gladiiferus*	(0- 4)	+					
27. *Arrenurus bachmanni* n. sp.	(2- 2)		+		+		
28. *Arrenurus funneliforme* n. sp.	(1- 0)	+					
29. *Thoracaphoracarus* sp.	(0- 4)				+		+
Σ species		10	11	10	13	7	5

extent such an 'individuality' of single waters is developed, further investigations may reveal. Hitherto there is not a single species dwelling in all five examined waters, which are located in the same region. 5 species show the widest distribution, yet dwelling in 4 of 5 waters: *Hydrodroma peregrina, Koenikea acuta, K. paraguayensis* n. sp., *K. retrocornuta* n. sp. and *K. spinosa*. The investigations simultaneously promoted on fishes revealed that the largest number of species is found in the shallow lake, too (13 species compared to at most 7 species in one of the ponds), and that even here not a single species dwells in all 5 waters (BRINKMANN & BÖTTGER 1990).

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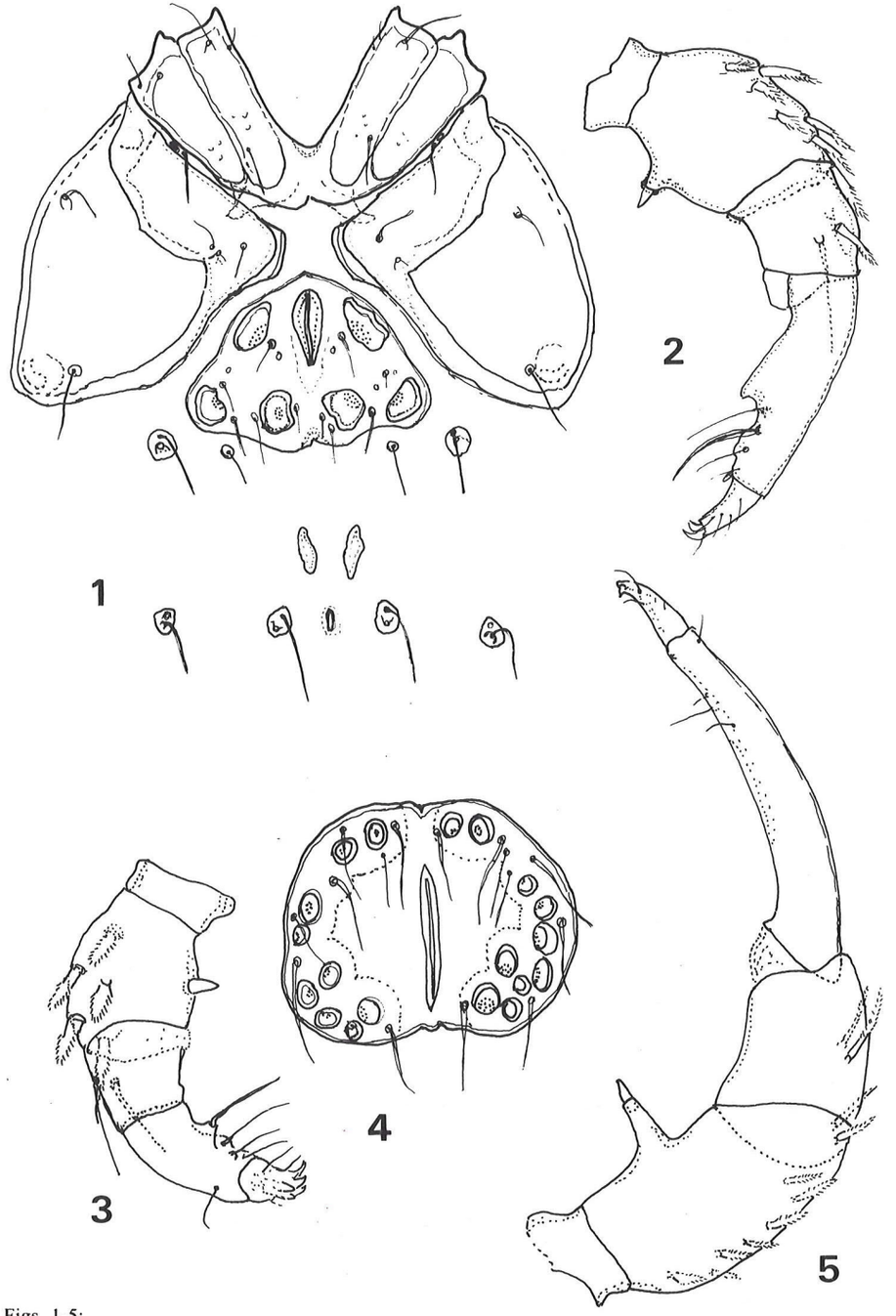
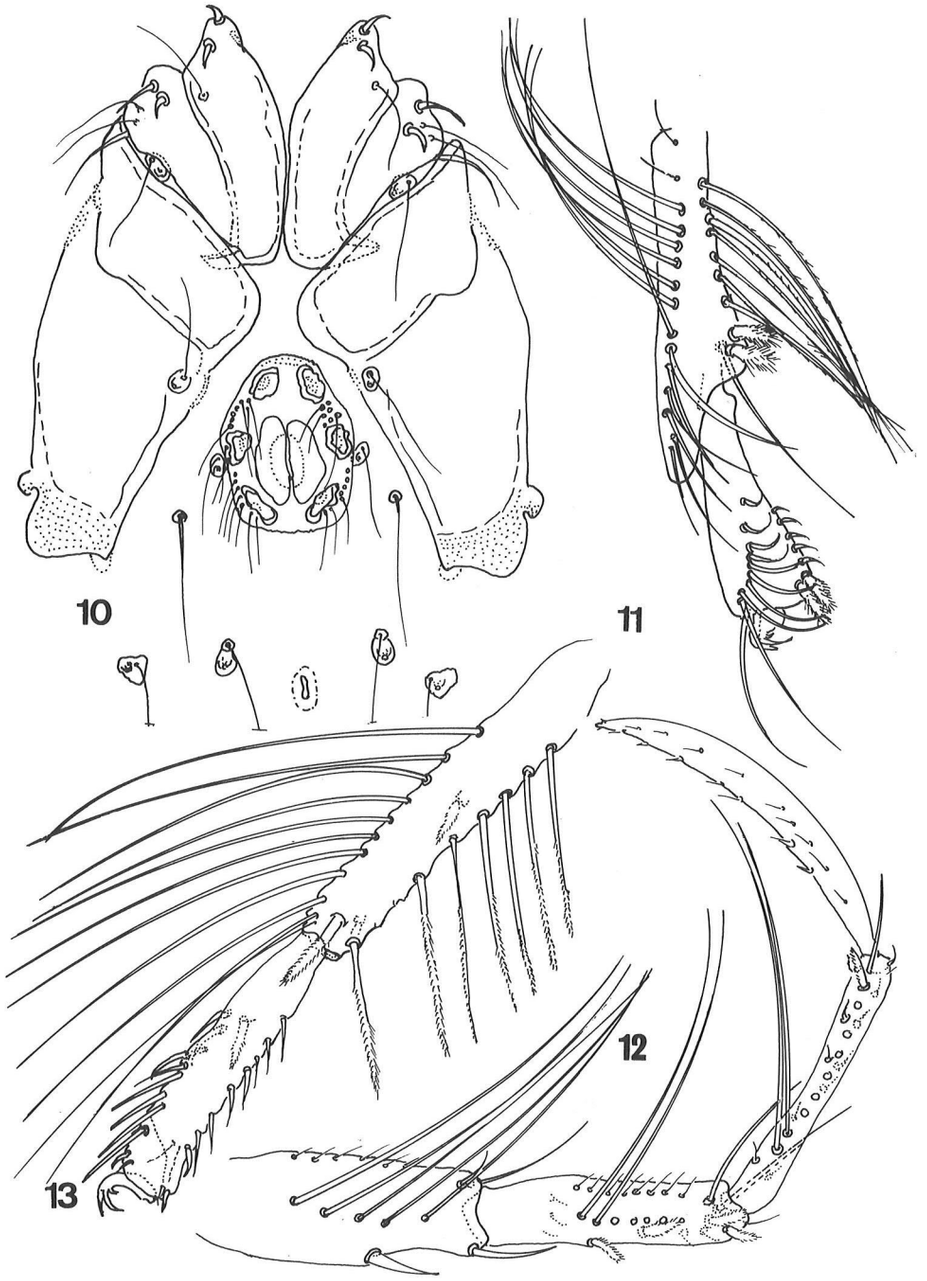
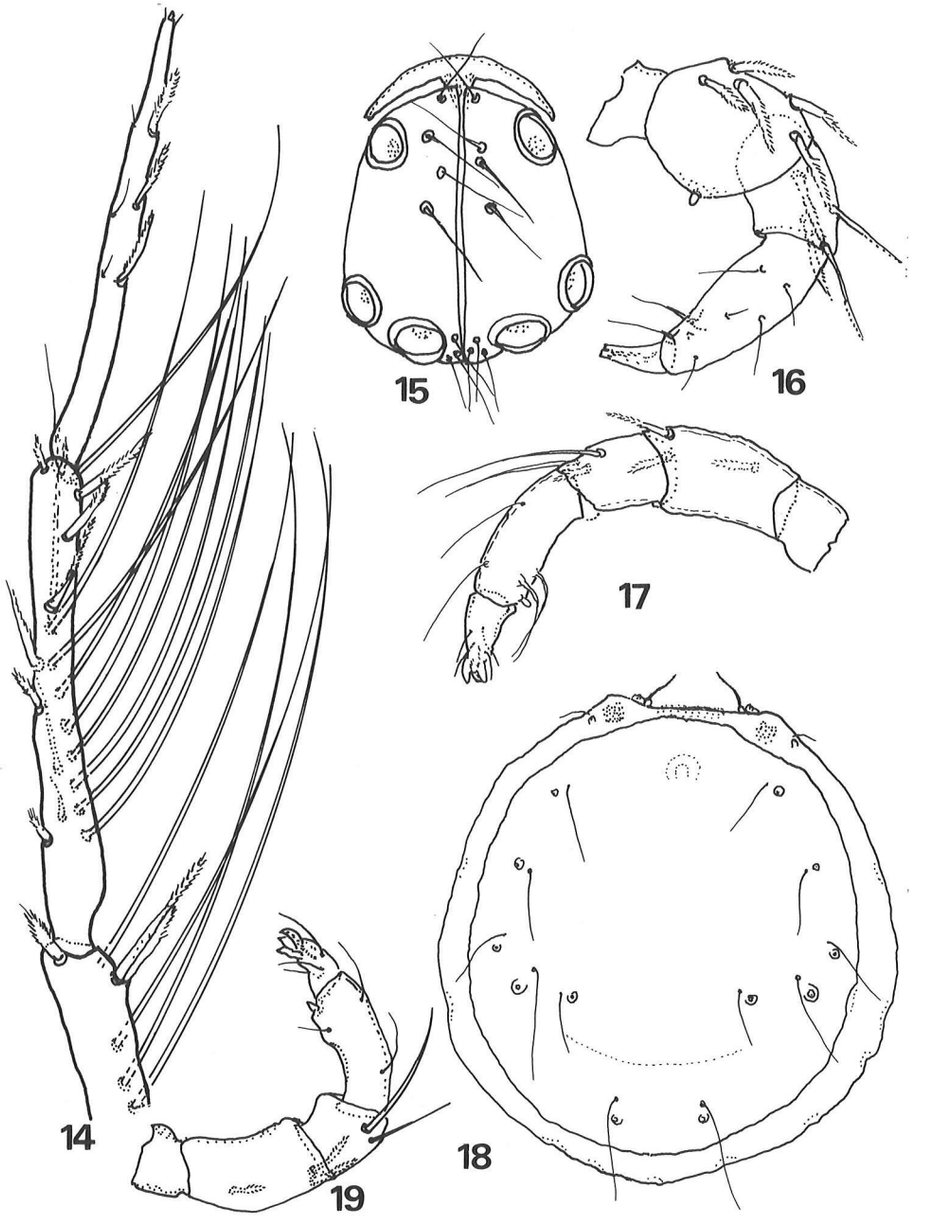


Figs. 1-5:
1-2: *Limnesia laeta* STOLL, male, **1**: ventral view; **2**: palp.
3-4: *Limnesia duricoria* (LUNDBLAD), male, **3**: palp; **4**: genital field.
5: *Limnesia polypora* VIETS, male, **5**: palp.

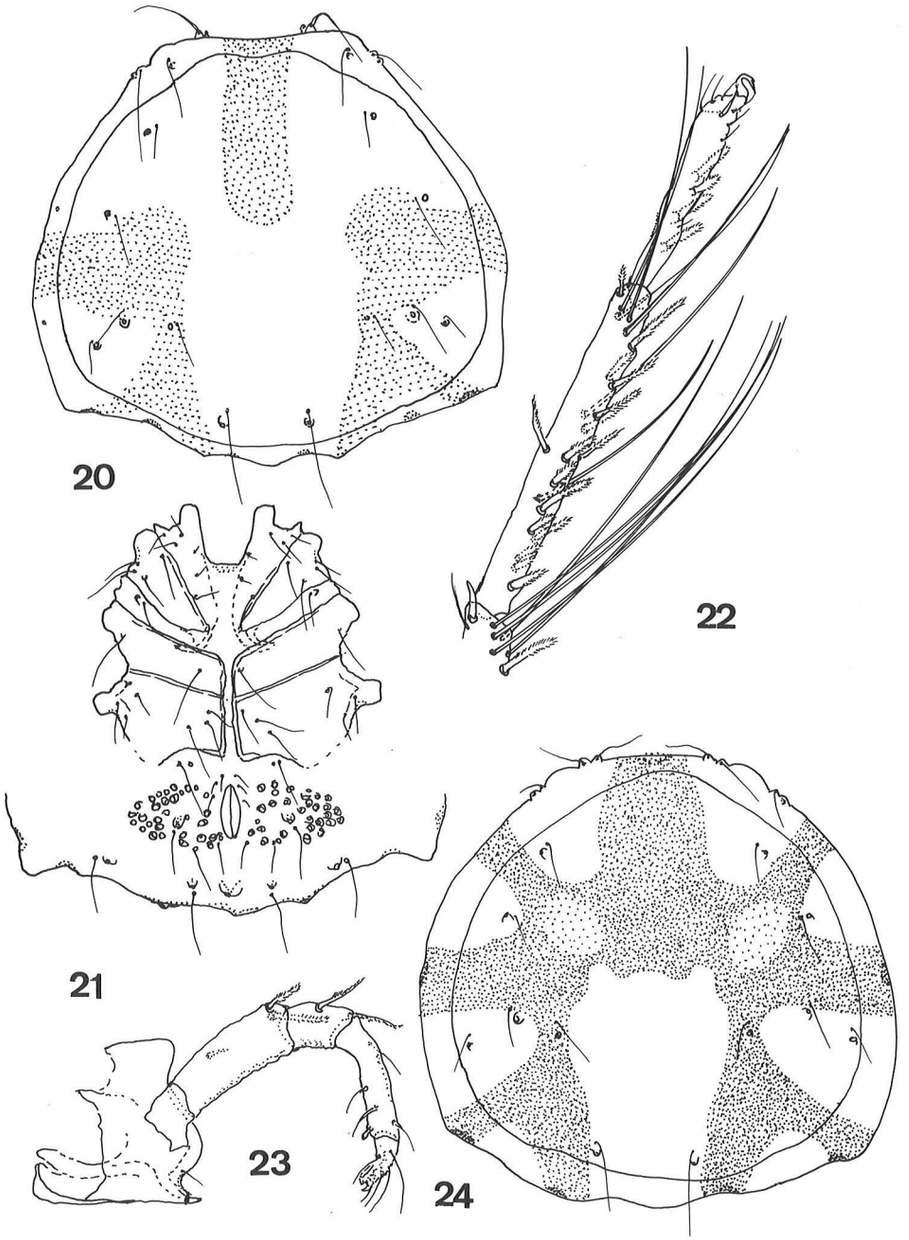
Figs. 6-9:
Limnesia polypora VIETS.
6: male, ventral view; **7**: male, fourth leg; **8**: female, ventral view; **9**: male, genital field.



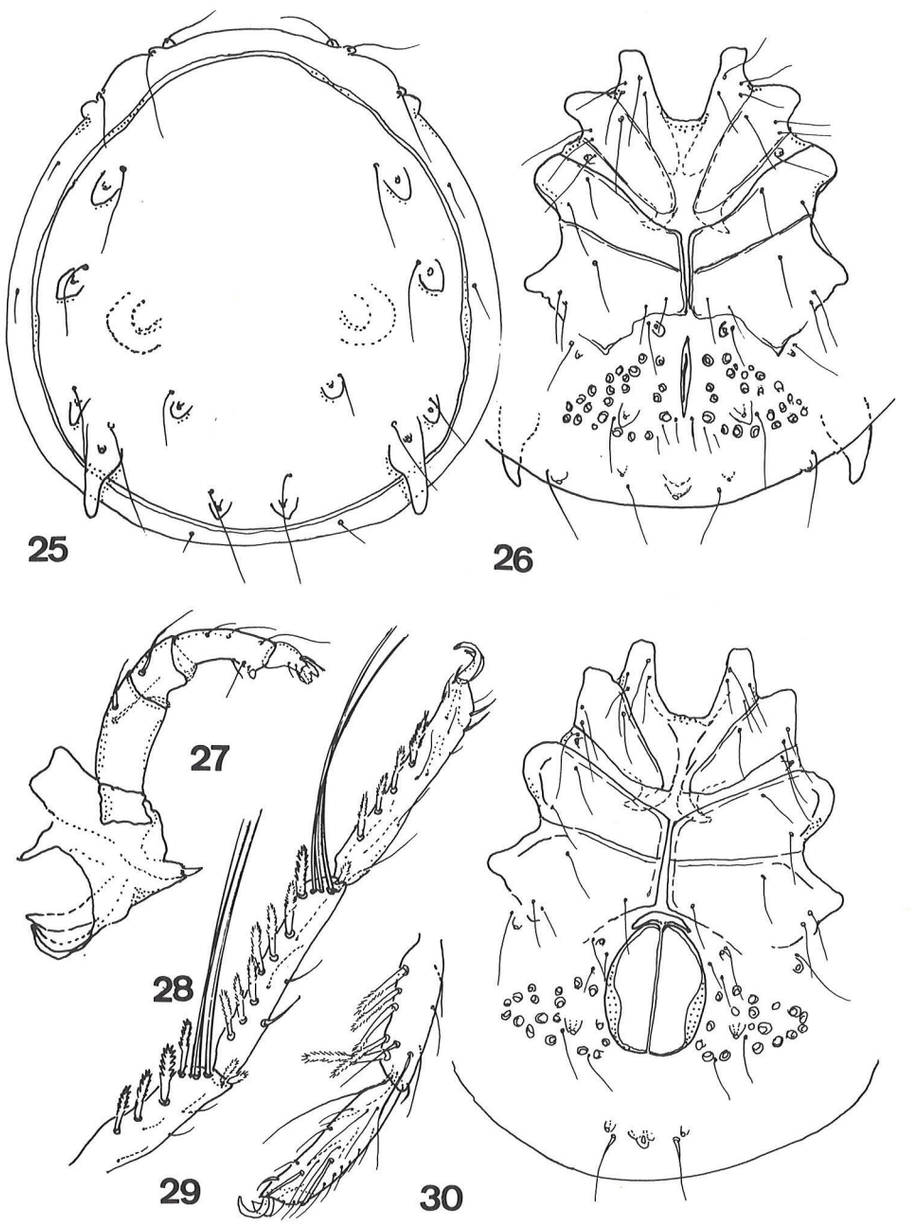
Figs. 10-13:
Centrolimnesia guarani n. sp.
10: male, ventral view; **11**: male, third leg; **12**: male, fourth leg; **13**: female, third leg.



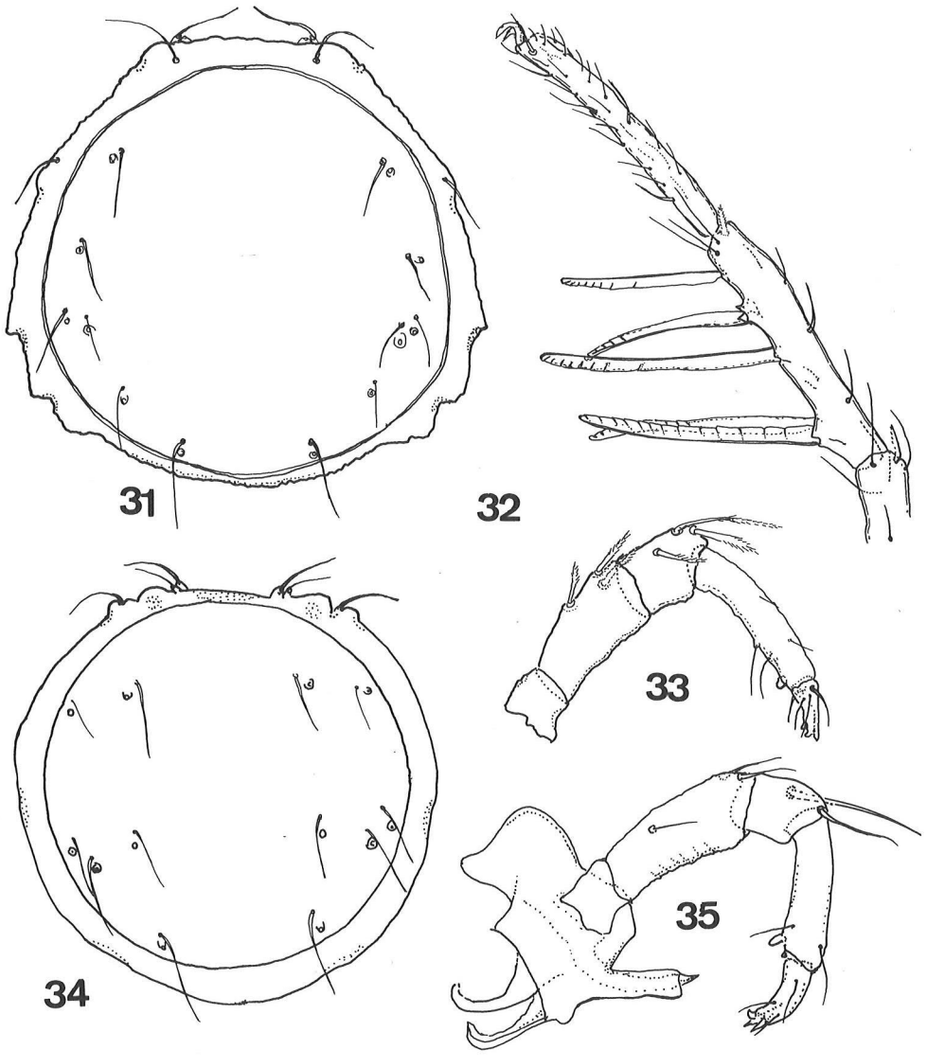
Figs. 14-19:
14-16: *Centrolimnesia guarani* n. sp., **14**: female, IV-leg-5 and 6; **15**: female, genital field; **16**: male, palp.
17-18: *Koenikea triangularis* LUNDBLAD, female: **17**: palp; **18**: dorsal view.
19: *Koenikea acuta* LUNDBLAD, male, **19**: palp.



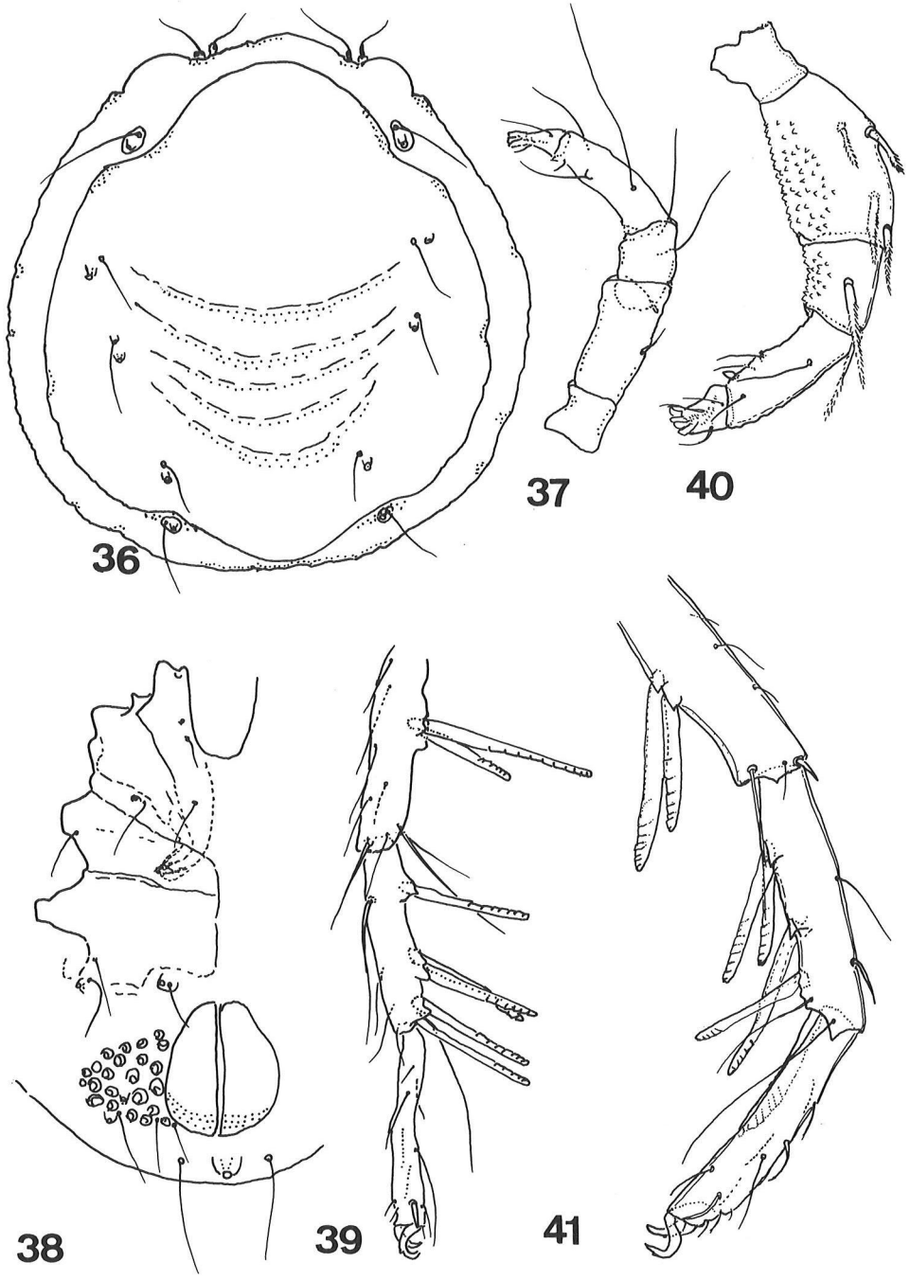
Figs. 20-24:
Koenikea paraguayensis n. sp.
20: male, dorsal view; **21**: male, ventral view; **22**: male, IV-leg-5 and 6; **23**: male, palp and capitulum; **24**: female, dorsal view.



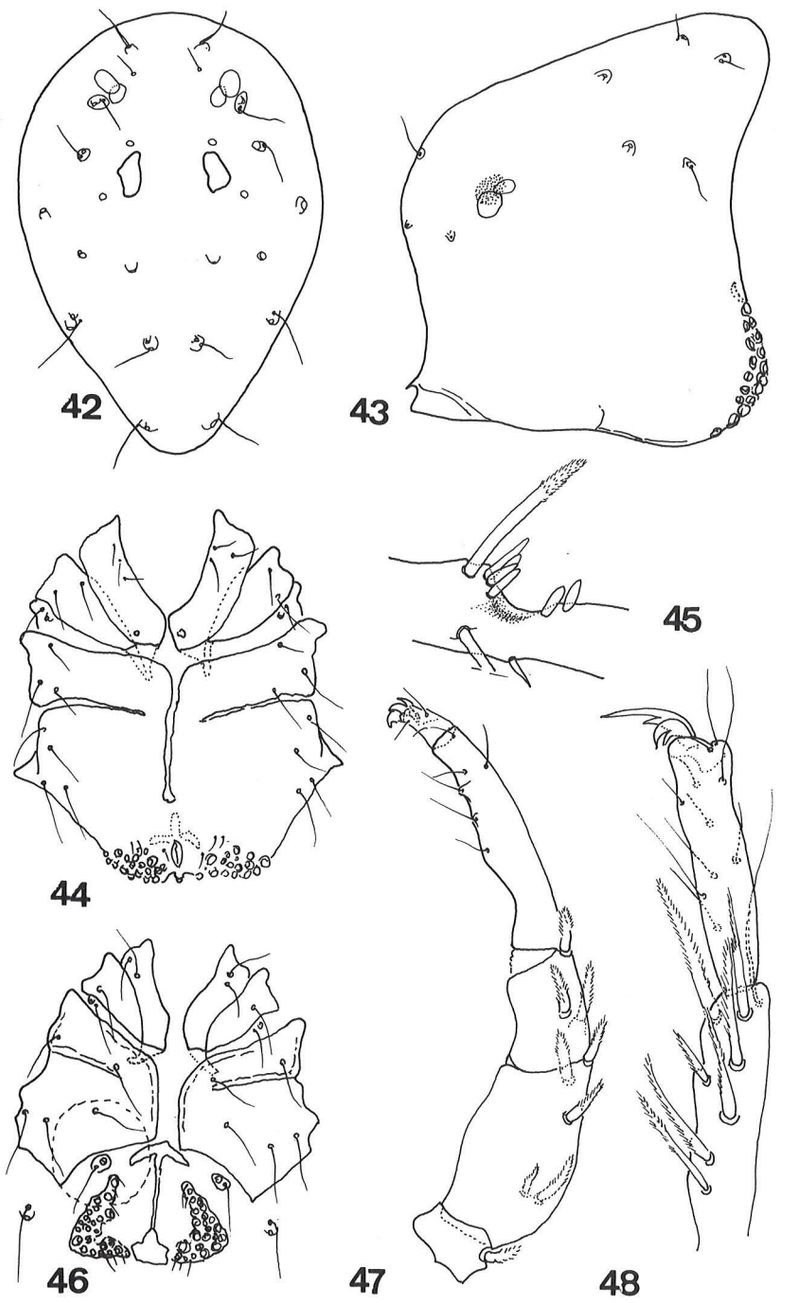
Figs. 25-30:
Koenikea retrocornuta n. sp.
25: male, dorsal view; **26**: male, ventral view; **27**: male, palp; **28**: male, IV-leg-5 and 6; **29**: male, I-leg-5 and 6; **30**: female, ventral view.



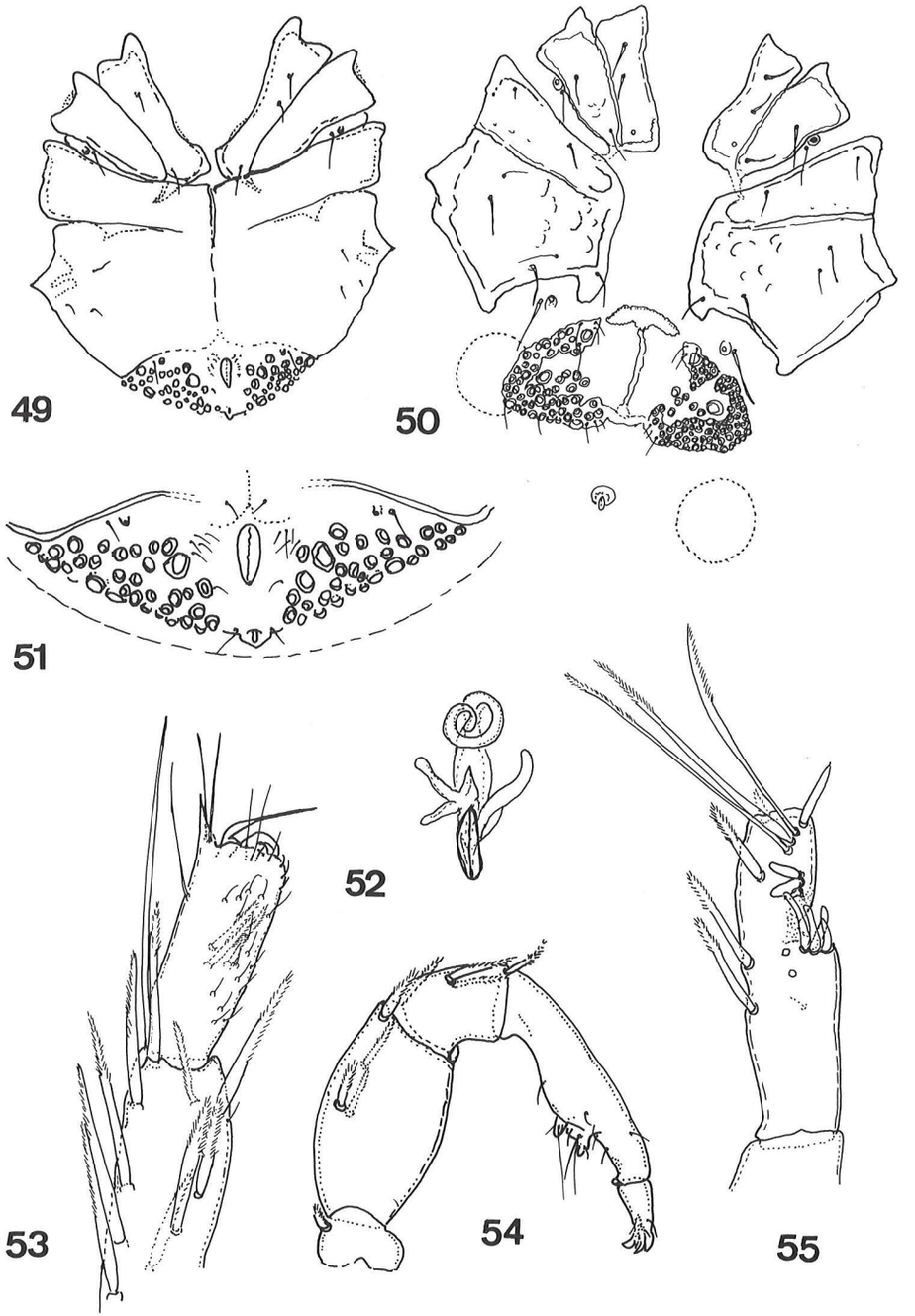
Figs. 31-35:
31-33: *Koenikea elegans* LUNDBLAD, male. **31**: dorsal view; **32**: I-leg-5 and 6; **33**: palp.
34-35: *Koenikea curvirostris* LUNDBLAD, female. **34**: dorsal view; **35**: capitulum and palp.



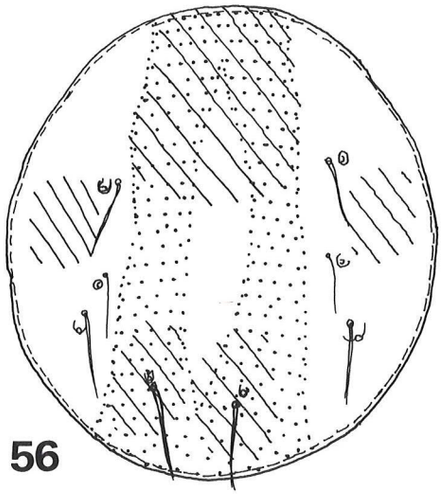
Figs. 36-41:
36-39: *Recifella excavata* LUNDBLAD, female. **36**: dorsal view; **37**: palp; **38**: ventral view; **39**: I-leg-4, 5 and 6.
40-41: *Recifella undulata* (LUNDBLAD), female. **40**: palp; **41**: I-leg-4, 5 and 6.

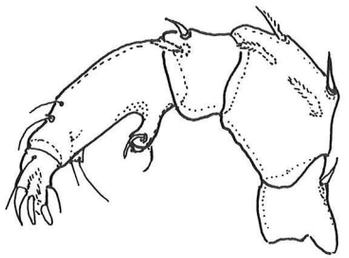


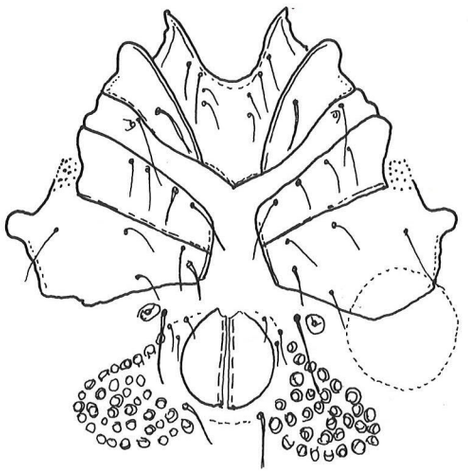
Figs. 42-48:
Piona deformis LUNDBLAD.
42: male, dorsal view; **43**: male, lateral view; **44**: male, palp; **45**: male, IV-leg-4; **46**: female, ventral view; **47**: male, palp; **48**: male, III-leg-5 and 6.

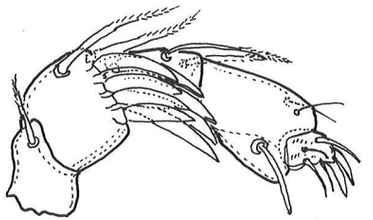


Figs. 49-55:
Piona davidcooki n. sp.
49: male, ventral view; **50**: female, ventral view; **51**: male, genital field; **52**: male, ejaculatory complex; **53**: male, III-leg-5 and 6; **54**: male, palp; **55**: male, IV-leg-4.





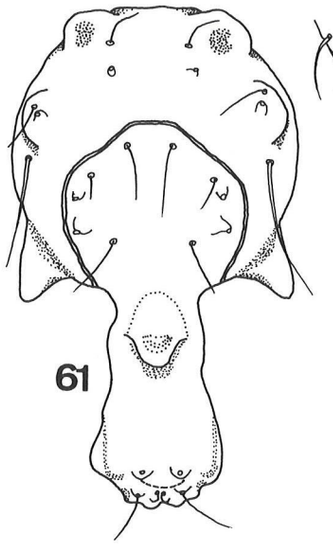


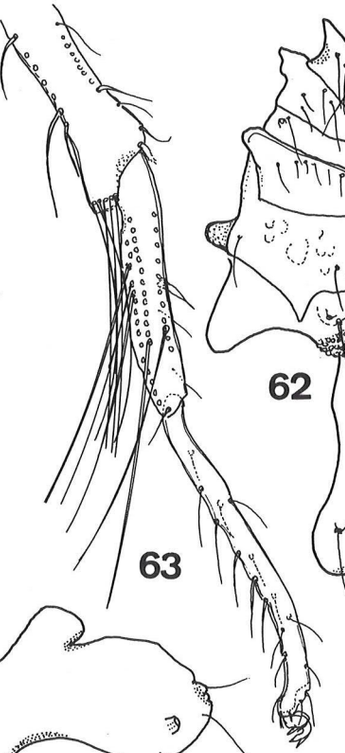


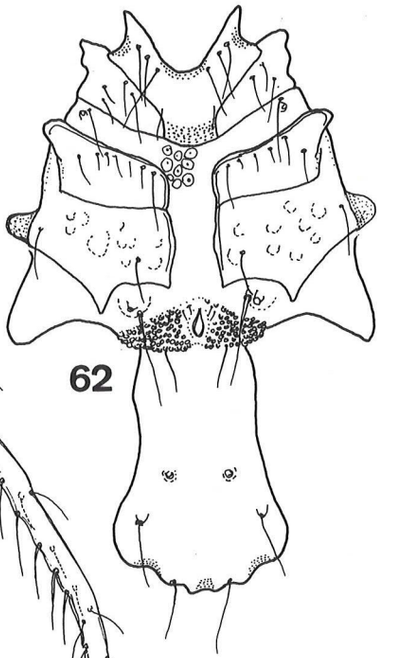
Figs. 56-60:

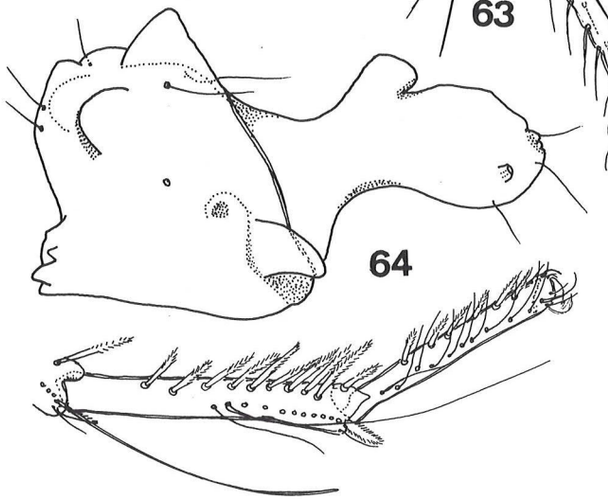
56-58: *Mideopsis sica* LUNDBLAD, female. **56**: dorsal shield; **57**: IV-leg-5 and 6; **58**: palp.

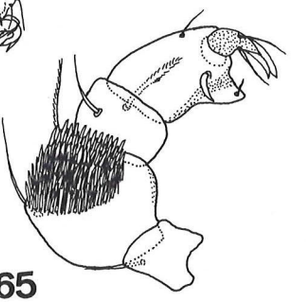
59-60: *Arrenurus gladiiferus* LUNDBLAD, female. **59**: ventral view; **60**: palp.

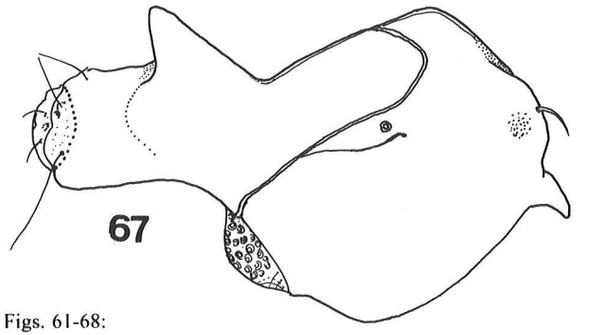


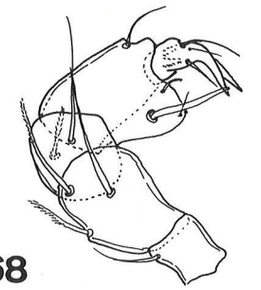








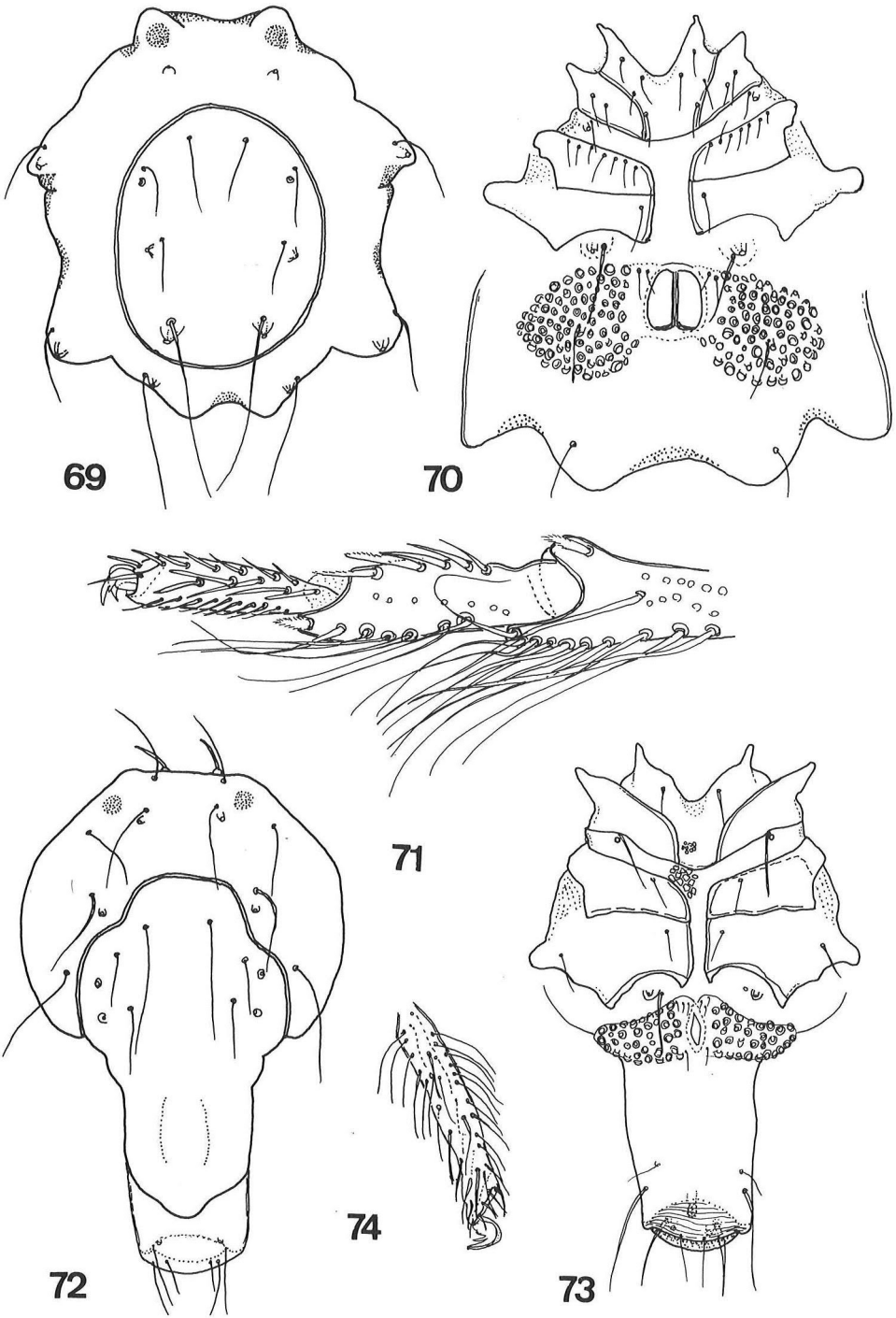




Figs. 61-68:

61-66: *Arrenurus bachmanni* n. sp. **61**: male, dorsal view; **62**: male, ventral view; **63**: male, IV-leg-4, 5 and 6; **64**: male, lateral view; **65**: male, palp; **66**: female, IV-leg-5 and 6.

67-68: *Arrenurus funneliforme* n. sp., male. **67**: lateral view; **68**: palp.



Figs. 69-74:

69-70 and **74**: *Arrenurus bachmanni* n. sp. **69**: female, dorsal view; **70**: female, ventral view; **74**: male, I-leg-6.

71-73: *Arrenurus funneliforme* n. sp., male. **71**: IV-leg-4, 5 and 6; **72**: dorsal view; **73**: ventral view.